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INCOSE
INTERNATIONAL COUNCIL ON SYSTEMS ENGINEERING

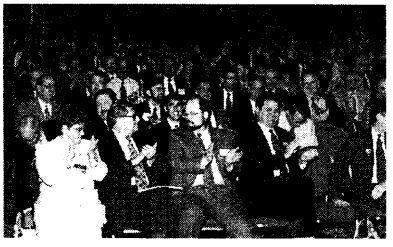
INSIGHT

Fall 1996
Issue 13

Report On The INCOSE'96 Symposium

Donald D. Neuman, INCOSE '96 General Chair, don_newman@star9gate.mitre.org
(Captions by Jennifer Anderson and Diana Arimento)

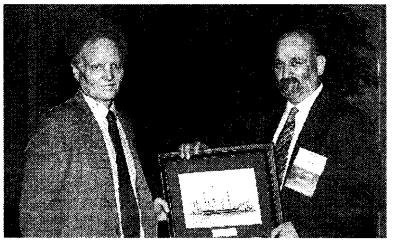
WE ALL CAN THANK THE INCOSE '96 Symposium Committee for their dedication and hard work that produced such a successful event. Judging from the attendance and the many, many comments from the membership, the symposium was clearly a crowd pleaser.



A huge crowd enjoys the opening ceremonies with the traditional Revolutionary War fife and drum leading the way. In the front row, from left to right, are Ginny Lentz (United Technologies Corp.), Bob Hermann (United Technologies Corp.), Pat Hale (Otis), Eric Honour (Harris), and 1/2 Brian McCay (Concept5).

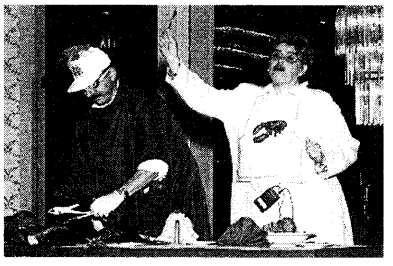
More than 800 participants from 10 countries assembled for the event, which featured the presentation of 130 papers. Over 400 attendees participated in one of the pre-symposium tutorials or the pre-symposium academic forum, and more than 300 people attended the clambake/lobster feast at the New England Aquarium.

Technical Program Chair Marty Ross introduces the 1996 Technical Program at the opening plena y session of the symposium.



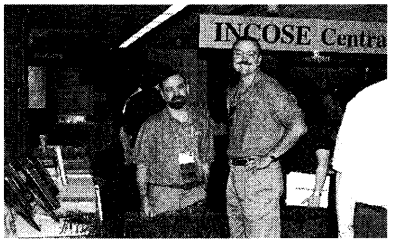
(Right) General Chair Don Neuman (MITRE), presents Lester Thurow (left), with a token of appreciation, a pen nnd ink drawing of the U.S.S. Constitution. Thurow, a world-renozuned economist, author, and educator, spoke nt Wednesday's Luncheon in thr Grand Ballroom

In keeping with our goal of strengthening the exhibits portion of the symposium, 36 vendors presented their products, and two new product lines were introduced to the attendees and media representatives.



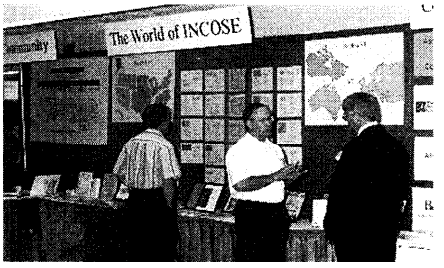
"Tutorial" Presentation at the Opening General Session–Some people have an interesting approach to lobster. Brian McCay (Concept5) and Ginny Lentz (Loral) are demonstrating the old "scare them to death" routine.

Our symposium was attended by the editors of IEEE Computer, and reporters from the Boston Business Journal and Mass HIGH TECH, which will continue to strengthen the reputation of the organization.



From left to right, Paul Clemente (Raytheon) and Mike Murphy (ALC), grinning amidst their success–University Exhibit Hall-with an impressive 36 vendors and 53 booths. Two new vendor product lines -were also introduced at the 1996 symposium.

I view the '96 symposium as a stepping stone to INCOSE's continued success, and from what Judy Peach has revealed about INCOSE '97 in Los Angeles, I think we can all look forward to an even better event next year.



Welcome to INCOSE Central! A red carpet helped make INCOSE's presence known in the exhibit hall The 1997 and 1998 symposiums were introduced here, and various systems engineering publications were available for purchase.

Inside This Issue

*"We have encountered a number of problems and delays in transitioning **INSIGHT** to the new editor. Please accept our apologies — we will do our utmost to get the next issue out on schedule!"*

SYMPOSIUM REPORTS

Putting the "I" in INCOSE

Brian McCay, bmccay@mitretek.org

INCOSE '96, our first "International" Symposium, offered a forum for a rich set of international activities. Eighty-three members from Australia, Brazil, Canada, France, Germany, Italy, The Netherlands, Norway, Sweden and the United Kingdom attended the Symposium. As part of the INCOSE Outreach Program, Ambassadors were named for three European countries: Gerard Le Lann for France, Bernhard Thome for Germany, and Harold Lawson for Sweden. The primary role of these Ambassadors is to promote INCOSE in regions that currently do not have chapter representation. A major goal is to engage and share ownership of technical areas of interest to increase international participation and hence strengthen INCOSE's technical products. In addition, Heinz Stoewer became Co-Chair of the Systems Engineering Management Technical Committee, while Richard Stevens became a Co-Chair of the Capability Assessment Working Group.

Best Paper Awards

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The following papers were selected as the best-in-track for the INCOSE '96 Symposium:

COTS/NDI Assessment and Selection Methodology
(Track 1, Paper 8.1.2)

Authors: D. Verma-Loral Federal Systems; T. Powers, B. S. Blanchard-Virginia Tech; R. G. Griffin, III, R. Webb, D. VanBuskirk–Loral Federal Systems

Abstract: In an effort to radically reduce system development times and necessary resources, the Department of Defense (DoD) is emphasizing utilization of "Commercial-Off-The Shelf" or "Non-Developmental Items" in the development of new systems and the upgrade of existing systems. This paper outlines a methodology, involving the integrated application of Quality Function Deployment (QFD) and Analytical Hierarchy Process (AHP), to facilitate the prerequisite analysis and evaluation before making a commitment to a COTS/NDI alternative. While this COTS/NDI analysis and evaluation methodology is generic in its application within the systems engineering process, in its current state the model based on this process has a system supportability bias.

Lessons Learned in the Selection of a Company Standard Requirements Management Tool
(Track 2, Paper 2.2.3)

Author: R. H. Acaba-Hughes Aircraft Co.

Abstract: As systems engineering automation tools become more mature, and systems become more complex, companies are realizing that they must make use of these tools in order to remain competitive. One of the issues that is commonly debated is whether to select and implement a company standard tool, or to allow individual projects to select their own tool. This paper describes the benefits and penalties of selecting standard tools and the rationale behind Hughes Aircraft Company's decision to select a standard requirements management tool. The process followed by Hughes to make the selection of a standard tool is described as are lessons learned during the implementation of the selection process.

Architecting Principles for Systems of Systems
(Track 3, Paper 7.3.3)

Author: M. W. Maier-University of Alabama in Huntsville

Abstract: While there is a growing recognition of the importance of "System-of-systems," there is little agreement on just what they are or on what principles they should be constructed. This paper proposes a taxonomy of these supersystems and exhibits a basic set of architecting principles to assist in their design. While several heuristics are particularly applicable to system-of-systems, the key insight is the central role played by communication standards. The enabling architecture of system-of-systems is non-physical, it is a set of standards that allow meaningful communication among the components. This is illustrated through existing and proposed systems.

Systems Engineering: Myth or Reality
(Track 4, Paper 9.4.2)

Author: J. Kasser-The Anticipatory Testing Group

Abstract: Each year at the National Council on Systems Engineering (NCOSE) symposium, lots of dedicated people spend a lot of energy assessing, measuring, and educating people about an incomplete body of knowledge (systems engineering). The incompleteness is due to the lack of a definition of what that body of knowledge is supposed to cover. Now, every systems engineer knows that it is important to capture of the requirements as early as possible in the program, so why have

the systems engineers not defined systems engineering? This situation led me to hypothesize that there was no such thing as systems engineering (after all, if the experts in INCOSE can't come up with one, then there isn't one).

System Integration Laboratory-A New Approach to Software/Electronics System Integration
(Track 5, Paper 1.5.4)

Authors: I? Kar, A. E. Kennedy, H. Kato-United Defense, Ground Systems Div.; I? Huang-United Defense, Armament Systems Division

Abstract: This paper describes the system definition and integration approach adopted for the Bradley Fighting Vehicle (BFV) M2A3 Engineering and Manufacturing Development program at United Defense LI? The BFV A3 Upgrade program incorporates lessons learned in the Desert Storm Operation. Upgrades are primarily in the area of fire control, electronics, and software. Modern electronics and software systems are relatively complex. Subsystems have to be integrated so that they perform cohesively to implement sophisticated systems functions with minimal supervision from human operators. This cohesive implementation, or system integration, requires special discipline, know-how, facility, and organization.

This paper describes a systems engineering approach that allows an understanding of the system early in the program, identifies problem areas, and generates candidate solutions before commencement of system design. It also describes the advantages of this approach. The approach described was used on the BFV A3 program. A System Integration Lab (SIL) was constructed and a rapid prototyping methodology was adopted to generate a simulation, emulation, and stimulation (SES) early in the program to allow for better understanding of the overall system. The SIL also created an incremental integration environment that allowed the system to be integrated using the philosophy of "build-a-little, test-a-little, and integrate-a-little" to simplify the integration tasks and reduce program risk.

FSEIG Ratify Their Charter

Bill Henderson, hendersonwf@hap.arnold.af.mil

At the INCOSE Symposium in Boston, the Facilities Systems Engineering Interest Group (FSEIG) met, ratified their charter, and elected board members. The primary topic of discussion was the need to increase membership and participation.

The purpose of the FSEIG is to provide a forum to exchange information on the practices of systems engineering at a broad range of facilities, independent of their product or service.

Persons who would like to participate in this Interest Group are requested to contact Bill Henderson at (615) 454-5295 or hendersonwf@hap.arnold.af.mil; or John Cunliffe at (415) 768-2227 or jccunlif@bechtel.com.

INCOSE FOUNDERS AWARD

Larry Pohlmann, pohlmann@boeing.com

Dr. Jerome (Jerry) G. Lake, membership number 6, who has been involved in INCOSE since it originated in 1990 (then as NCOSE), received an INCOSE Founders Award at our annual symposium in Boston. This is only the second time this award has been given: The first recipient, in 1992, was Carl Spiegelberg who co-authored our INCOSE mission and charter statement. The award consists of a plaque and a red sweater (see the Historical Note article on page 36).

Jerry is a principal of Systems Management international (SMi), a consulting and training company. He has served previously in a number of prestigious military and academic R&D and management positions. His most recent previous position was a Professor of Systems Engineering at the Defense Systems Management College. Jerry has authored numerous publications on systems engineering topics and has presented many systems engineering seminars and workshops in the United States and internationally.

Jerry served as the first elected NCOSE President, in 1992, and was later elected as one of our two current Directors-At-Large. He represents the Board of Directors on the INCOSE Technical Board.

Jerry has been INCOSE's most active member in the area of systems engineering standards development and serves on the joint INCOSE, EIA, and IEEE Systems Engineering Standard committee. He was one of the principal authors of the draft MIL-STD-499B. He helped to convert and adapt this standard into the EIA/IS 632 Systems Engineering standard and the IEEE 1220-1994 Trial-Use Standard for the Application and Management of the Systems Engineering Process. Currently he represents INCOSE on the JTC1/SC7/WG7 committee which is preparing an IS0 systems standard.

Thank you, Jerry, for your long-standing contributions to INCOSE and to the field of systems engineering. And again, congratulations!

1996 INCOSE Symposium: Statistics on Parade!

Ellen Barker, nelle@u.washington.edu

INCOSE's Sixth Annual International Symposium-July 7-11, 1996 in Boston, Massachusetts-was memorable in many ways, including the fact that it broke all sorts of records! For those interested in the numbers, here is a mini-statistical profile:

In keeping with our international name change, we continued to increase participation from outside the United States with 92 attendees (11 percent of the 813 total), representing 10 countries and 56 companies. This is an increase relative to 1995, when international participation totaled 8 percent. The number of countries represented also increased, with Italy and Brazil joining us in Boston.

Attendance from the five INCOSE US regions was as follows: Region I-5 percent; Region II-20 percent; Region III-14 percent; Region IV-28 percent; and Region V-22 percent. California continued its annual lead in the category of "percentage of participants by state" with 16.6 percent. However, over 50 percent of the total attendance was from the East Coast, with 11 percent being from the New England area. US participants represented approximately 255 companies-depending upon which mergers happened during a given week. Technical papers were submitted by 274 authors representing 128 companies. Of the 199 initial papers submitted-including 6 invited papers-155 were chosen for presentation and 26 were selected as poster or alternate papers.

This year, in the professional development arena, a record 398 people took advantage of the eight tutorials and the academic forum.

The exhibits program also reached a new record in 1996 with 35 companies exhibiting. In addition an INCOSE superbooth included everything you ever wanted to know about INCOSE and the 1997 and 1998 symposia.

Many people took advantage of the symposium to join INCOSE or renew their membership, this year totaling a record 246 new and 186 renewing members! Of **the** 813 attendees, 729 were INCOSE members- almost 90 percent! (Now, how about those remaining 10 percent?)

The New England Clambake at the New England Aquarium proved to be a real hit, with over 300 people (unintentionally) flinging lobster shells at their dining companions! All in all, the 1996 symposium was a success on the professional as well as the social front.

No Need to Wait Until Los Angeles!

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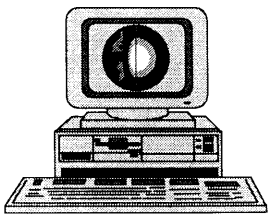

Find the latest information about Vitech and CORE at http://www.vtcorp.com.

PRESIDENT'S CORNER

Ginny Lentz, lentzva@utrc.utc.com

What's in a name? Recognition? Persona? Cognitive style? A set of skills? All of the above and more.

The International Council on Systems Engineering is only six years old. We still get more "what's INCOSE?" than name recognition. Systems engineering has been taking place for thousands of years-some one, or a small group, did the systems engineering for each Pyramid. Thus, the early recognition of the need for the technical integrator-the keeper of the technical integrity for large, complex projects. The period around World War II brought an explosion in communications and computing capability. Complex projects with a single craftsperson and a few assistants or technicians, lacked the breadth and depth of skills to complete a project. Not that the craftsperson could not learn all the necessary skills, but rather schedule (time to market) did not allow one person, or a small group, time to learn enough to perform all the aspects of the job. Technical diversity in resolving community needs forced us to recognize the need for systems engineering.

The codification of systems engineering began in the communications industry and moved to the Defense industry where full rigor was applied. This rigor, and the resultant application of standards, might be part of the problem that the community at large has with the term systems engineering (SE). It took one of my former companies until 1984 to decide to implement a job code with training for persons doing systems engineering. Until that point, the Chief Engineer, whether from a hardware or software background, provided technical oversight and integrity. This was not done in a vacuum but accomplished in partnership with the Customer and the Program Manager. The Chief Engineer also had the support of a large technical community of doers.

With a job code come training and procedures. The diversity of the components and technologies also created other job codes, and training and process packages. This diversity of training and processes eventually built walls between the disciplines. New initiatives such as concurrent engineering, which evolved into integrated product and process development, were started to break down the walls. Our commercial colleagues readily adopted concurrent engineering to reduce rework on the manufacturing floor, sometimes using other names such as simultaneous engineering and parallel engineering. Bottom line, they are all synonyms for SE as it was originally performed and envisioned. We needed new names to overcome the resistance to what SE had become. Other ways to obfuscate the need for SE, by that name, continue to pop up-design is one of the recent ones. Another is the reordering of the terms to engineering of systems.

INCOSE founders decided to defer defining this elephant -and properly so. To define SE would have delayed the formation and accomplishments of a key organization for doing business in the 21st Century. I think Lester Thurow, an INCOSE '96 Symposium Luncheon speaker, gave us a fine challenge when he concluded with the need for a new way of doing business in today's global environment. It took INCOSE four years to choose a definition of system and systems engineering. We have proved yet again that one cannot please all of the people all of the time. Indeed several of our esteemed colleagues do not like the definitions and there is still a contingent that think definitions are unnecessary. The existence of the definitions is almost more important that the content: There are persons will who question whether we understand how to accomplish world-class systems engineering if we cannot define the term.

We are all trying to satisfy diverse communities and appeal to them all. Can we ever accomplish our goal? Are we better off to keep calling this rose a rose and help the rest of the world understand that systems engineering lite exists. We can tailor the SE processes and methods to their situation. SE is just good business practice! I think we were chartered and are in business to convince the rest of those folks to join us.

Now that we have definitions, the bad news is that we are back to arguing about the terms system and engineer. The words systems engineering carries the baggage of its DoD legacy. That legacy includes all the late MIL-STDs, and reams of documentation (the manifestation of the systems engineer's product in the early days of the program). The real product of the systems engineers is the SYSTEM-and I know there are those of you out there who will argue with me whether or not the system is a product. The effort of tying the technical effort together needs to be done. The doer might be called systems engineer or Integrated Product Team (IPT) Lead or designer or chief engineer. The people who do that job will have an understanding of the customer, the need, the solution space, the alternatives, and the risks. We are in the business of applying technology to solving a customer's needs-whether that need is for family transportation on the highways or for communication across the skyways. If we are in the business of applying technology because we have technology to apply, we are technology engineers, not systems engineers; however, in either case we are engineering systems.

We have not yet defined what it means to be a Systems Engineer. Indeed, Sarah Sheard identified a dozen roles for a systems engineer in the INCOSE '96 Proceedings. Does one perform all of Sarah's dozen roles or does one merely have cognizance of all of Sarah's roles, a rolodex, and an aptitude for mediating conflict? If not all, how many of the roles is one required to be capable of performing to have the job code of Systems Engineer? Is a decision on this topic necessary for establishing professional credentials and training and certification criteria for systems engineers? Applying our INTUITION we have moved into the education and training arena without a firm definition for System Engineer. Yes, we may have to change the certification program guidelines later; however, for now we have useful guidelines. Thanks, Education and Training Working Group!

The term program management also came into wide use following WWII. I have not heard a case for changing the name of the Program Management Institute to the Institute for Managing Complex Programs. We are the International Council on Systems Engineering—not Systems Engineers. Persons who do systems engineering, whether by our formal definition or some other, should feel welcome.

WORKING GROUPS

Technical Community Status

Brian McCay, bmccay@concept5.com

The technical community delivered several products at the symposium and announced progress on many high priority items of importance to the CAB (Corporate Advisory Board) and membership at large. Two major products delivered to the CAB were the Systems Engineering Capability Assessment Model (SECAM), V1.5 and the Systems Engineering Handbook.

The SECAM, developed under the leadership of E. Richard Widmann and Blake Andrews, demonstrates the high caliber of technical content that our WGs are capable of delivering. (See Professional Agreement with EIA).

The SE Handbook, an outstanding effort led by Tim Robertson and the entire San Francisco Bay Area Chapter, was completed and is available for review.

Both of these products are available from the INCOSE home office.

A host of other important products were delivered and made available as part of Volume II of the Symposium Proceedings. These include: Course Descriptions of a Certification Program in Systems Engineering; Systems Engineering Applications Profile, Version 1.0; Foundational Concepts for Model Driven System Design; Scenarios Leading Towards a Concept of Operations for an Integrated Systems Engineering Environment; Characteristics of Good Requirements; and Moving Towards an Integrated Set of Products for Measuring Systems Engineering.

Additional technical work can be found at INCOSE's web site (www.incose.org).

Standards Development

Brian McCay, bmccay@concept5.com

INCOSE's participation in standards continues to gain momentum in three major areas. Dr. Jerry Lake is a US SC7 Technical Advisory Group member for the Standard for System Life Cycle Processes.

John Snoderly heads an INCOSE contingent participating in the EIA (Electronics Industry Association) 632 Standard: Process for Engineering a System. Other INCOSE participants include Barbara Armstead, Bruce Pittman, Robert Shishko and Randy Zittel.

Blake Andrews and E. Richard Widmann are representing INCOSE on the EIA Systems Engineering Capability Model Working Group. This effort, led by Karl Arunski, is of particular importance. The WG is creating a single Systems Engineering Capability Model that will reflect the outstanding contributions and previous work of both INCOSE - SECAM V1.5, and the Enterprise Process Improvement Collaboration (EPIC) - SE CMM.

Measurement Technical Committee

Rich Widmann, 0069222@msgate.emis.hac.com
Bill Miller, william.d.miller@att.com

In addition to the products descussed elsewhere in this issue of INSIGHT, the Measurement Technical Committee has pursued another objective of providing support services, such as training, that enable the effective usage of the developed measurement products. Without support, these products might become "shelfware." Several chairs / co-chairs of the Measurement Technical Committee and three of its WGs (Capability Assessment, Metrics, and Benchmarking) provided 8 hours of informal training at the 1996 winter workshop and a tutorial at the Symposium. The tutorial was entitled "Technologies for Systems Engineering Measurements: A Tutorial by the INCOSE Measurement Technical Committee."

Both the informal training and tutorial covered the usage of the Metrics Guidebook and the INCOSE SECAM and its Assessment Method, as well as information on benchmarking. Emphasis was on the measurement of various systems engineering activities and the setting up of a measurements program. The intent was to ensure that INCOSE members are given every opportunity to learn about and use these products to measure and improve their systems engineering activities.

Another objective has been to develop products in an integrated fashion. The Measurement Technical Committee has striven to ensure that the measurement products developed by its WGs have been coordinated and reviewed within the Measurement Technical Committee and reviewed across INCOSE as a whole. For instance, the taxonomy of the Metrics Guidebook for Integrated Systems and Product Development was influenced by the INCOSE SECAM. Similarly, the treatment of metrics within the SECAM was influenced by the Metrics Guidebook. Also, the individual metrics within the Metrics-In-Use Catalog are referenced to an applicable KFA within the INCOSE SECAM. Similarly, the training provided by the Measurement Technical Committee has been coordinated between the WGs to enhance its effectiveness.

Metrics Working Group

Bill Miller, william.d.miller@att.com

Kudos to Jennifer Dunn (Tellabs) and Donna Rhodes (Lockheed Martin Federal Systems) for their contributions to producing WG products and to Ann Wilbur (Synopsys) for support INCOSE produced tutorial.

Jennifer drafted the metrics primer and led the initial review.

Donna demonstrated the prototype Metrics Information Systems Tool (MIST) at the opening plenary session at the Symposium. MIST is being developed under the sponsorship of the Naval Surface Warfare Center, and the metrics-in-use catalog produced by the working group is being migrated to MIST. Donna also updated the System Engineering Metrics Annotated Bibliography, another WG product.

Ann provided an overview of the "Metrics Guidebook for Integrated Systems and Product Development" at the "Technologies for Systems Engineering Measurements" tutorial put on by the Measurement Technical Committee.

The Metrics WG will meet this fall to review a second draft of the metrics primer with the intent to have it ready for submission to the INCOSE Technical Board at the 1997 winter workshop. The WG will also review a draft of information for the INCOSE web site. The WG intends to seek Technical Board approval to change the status of the Metrics Guidebook from an interim technical product to a technical product.

If you or your local chapter is interested in helping provide metrics products or you want to find out about WG activities, contact Donna Rhodes at donna.rhodes@lmco.com.

Capability Assessment Working Group Activities

Blake Andrews, baandrew@crems.cca.rockwell.com
Don Barber, Don.Barber@cas.honeywell.com
John Worl, worl@battelle.org

Thanks to everyone that participated in the Capability Assessment Working Group (CAWG) during the Symposium. Approximately 20 CAWG members participated in our two sessions.

The CAWG made significant contributions to this year's symposium including release of SECAM V1.5 of the INCOSE Systems Engineering Capability Assessment Model, informal distribution of a draft of the SECAM Assessment Method, and participation in a tutorial on SE measurement.

Version 1.5 of the INCOSE SECAM and the SECAM Questionnaire are available through the INCOSE home office. Version 1.5 represents a major improvement to the INCOSE SECAM. Generic attributes and unique themes used within each Key Focus Area of the model are now formally identified. Non-process attributes are also included as part of the model to "sanity check" the results implied by responses to process focused questions.

Version 1.5 was piloted in 9 separate assessments, bringing the total number of assessments conducted using the INCOSE SECAM and its predecessor models to 21. The CAWG would like to recognize and thank the following companies for their assistance in making SECAM a success: Loral Command & Control Systems; Grumman; Loral Space & Range Systems; Hughes Aircraft Company Electra-Optical Systems; Rockwell Commercial Air Transport Div.; Computer Sciences Corp.; Westinghouse Hanford Co.; Raytheon Missile Systems Div.; U.S. Dept. of Agriculture North Central Soil Conservation Research Laboratory; Battelle Memorial Institute; TRW System Integration; Honeywell Industrial Automation & Controls Div.; Boeing Defense and Space Div.; AT&T Corp.; and Lucent Technologies.

The CAWG plans to release a separate assessment method document; prior to Version 1.5 it was included with the model. A draft SECAM Assessment Method document was distributed to CAWG participants at the symposium.

CAWG members decided to concentrate on developing tools to assist the assessment process. Planned products are a SECAM Assessment Method document and an electronic toolkit. The SECAM Assessment Method document will be based on the current draft. The electronic toolkit is a collection of MS-Office-based tools for assessment preparations and scoring for each Key Focus Area. Draft versions are planned for the winter workshop.

For more information about the CAWG, its activities and products, or assessment facilitation, contact Blake Andrews, John Worl, or Don Barber.

Honeywell's SE Process Assessment Using SECAM Version 1.5

Don Barber, don.barber@cas.honeywell.com

Honeywell's Systems Engineering Committee (SysEC) sponsored the assessment of Honeywell's Industrial Automation and Control Division, a commercial business that develops process control systems for a variety of industries including; petro-chemical, textiles, automotive, pharmaceuticals, pulp and paper, and food products.

The SysEC wanted to gain experience with the model and decide whether a model-based approach should be used across the corporation. Also, the SysEC wanted a process that would: (1) identify the organization's process strengths and weaknesses, (2) establish a baseline for process improvement, and (3) provide some systems engineering training.

A complete SE Process Assessment was conducted using Version 1.5 of the INCOSE Systems Engineering Capability Assessment Model. The assessment team was comprised of two members of the Capability Assessment WG plus experienced engineers from various Honeywell divisions.

The assessment team made several modifications to the standard assessment process based on knowledge of the organization being assessed. These included removing the Subcontract Management Key Focus Area and level 4 and 5 questions from the questionnaire; free format individual interviews with the assessors filling in gaps using the exploratory questions; participants from various organizational levels mixed in the group discussions; all major issues presented instead of rolling up into 5-7 findings; and granularity of 0.25 for scoring to highlight differences between KFAs.

The 4 assessors and 21 participants spent a total of 280 hours performing the assessment.

The assessment team identified items that worked well and items that could have been done better. The following are worth noting:

- A good understanding of the organizational structure is essential to identifying the right participants and understanding their local lexicon.
- The questionnaire is long and participants tended to "lose energy" as they progressed through the Key Focus Areas.
- The assessment team needs to see some physical evidence of systems engineering activities.

*There was not always a strong correlation between the responses on the questionnaire and the comments in the interviews. This was attributed to lexicon differences.

*There needs to be better alignment between the questionnaire, exploratory questions, and the scoring methods.

Overall, the assessment was very successful. Participants and management agreed with the issues identified by the assessment. Even with the free form interviews, all of the issues identified mapped well to the model's Key Focus Areas. In other words, the assessment team did not find any holes in the model. The assessment team concluded that the process was an effective way to identifying an organization's strengths and weaknesses, and that it provided a solid baseline for developing action plans and measuring future progress.

Requirements Working Group

Pradip Kar, pradip_kar@fmc.com

Rob Rhodes can put RWG papers on the RWG web site, so send your material to him at rhodesr@clark.net.

Dave Jones, Marty Bell, Quinton Heckert, and Frank Hollenbach met to discuss the requirement tool interfaces paper at the Symposium.

The WG discussed developing a handbook, video, comic book, or other form of corrtmunications on the cost of doing requirements poorly. These would contain case histories about failures of systems, loss of money, and other catastrophies that can be credited to poor requirements. We are looking for someone to take the lead in this area.

A trifold describing the charter and objectives of the Requirements WG (RWG) was distributed at the Symposium.

Education and Training Technical Committee

John Velman, velman@igate1.hac.com
Joseph Spigai, jspigai@aol.com

After a very successful academic workshop at the Symposium, joint WG meetings were held by the Academic Development WG (ADWG), and the Professional Development WG (PDWG). A coordinated strategic plan for the next three years was prepared. It deals with issues of certification and accreditation that are of interest to INCOSE.

The ADWG has produced a syllabus for a model certificate program, based on a continuing education environment. The syllabus was published in Vol. 2 of the Proceedings and is available separately from the ETTC. Brian Mar has provided a draft Educational

Effectiveness Assessment Model which the ADWG will refine for discussion at the winter workshop. The goal is to have an 'alpha test' version ready next summer. In addition, the ADWG is recommending that the Board of Directors give further consideration to applying for ABET membership.

In parallel, the PDWG has completed 'release' versions of a model Systems Engineer Profile and a systems engineering taxonomy model for developing training programs in an industrial setting. These will draw on the work of other INCOSE WGs, but will be tailored and formatted for the intended application. Issues relating to setting certification standards for systems engineers are also being considered. Draft certification standards for systems engineers will be developed in 1997.

As a companion to the ADWG Educational Effectiveness Assessment Model, the PDWG is starting work on a similar model to assess the effectiveness of training in an industrial setting.

Kevin Dutcher has become co-chair of the PDWG, and will be assisting Dick Phillips. Joe Spigai is continuing as chair of the ADWG, and desperately needs a co-chair. And of course, we need workers. Anyone who is interested in participating in this activity please contact either John Velman, Joe Spigai (email addresses listed above), Dick Phillips (dwp@cmu.edu), or Kevin Dutcher (dutcherk@gdls.com).

SE Applications Technical Committee

Bill Schoening wschoening@mdc.com

Bill Mackey, my new co-chair, and I are fostering the formation of applications WGs and IGs. A Telecommunications IG led by Carolyn Buford and Kip Klish has been spawned by the SE Applications Forum WG. Jerry Fisher is working on Software Systems Engineering. Other members have expressed interest in forming WGs in nuclear waste disposal, commercial aircraft, healthcare, information systems, civil engineering, and automotive.

Please contact Bill Mackey (wmackey@cscgt.gsfc.nasa.gov) or me about your area of interest. Our job is to help you find others with similar interests.

Facilities SE Interest Group

Bill Henderson, hendersonwf@hap.arnold.af.mil

The FSEIG met at the symposium, ratified its charter, and elected board members. The primary issue was how to increase membership and participation.

The FSEIG is a forum to exchange information of the practices of systems engineering at a broad range of facilities, independent of their product of service. Persons who would like to participate in this IG should contact me at 615-454-5295 or John Cunliffe at 415-768-2227 or jccunlif@bechtel.com.

Software Systems Engineering Interest Group

Jerry Fisher, gfisher@hq.caci.com

I am starting an IG that looks at how systems engineers and computer scientists work together to address productivity, quality, reduced time to market and profitability. The focus will be determined by those in the IG. Two potential areas of interest are object-oriented design and software reengineering of legacy systems.

The winter workshop will be an excellent time for the formation meeting. However, attendance at the winter workshop is by invitation only, so you need to contact me now at 7038418824, FAX 703-841-8887, or by e-mail.

Benchmarking Working Group

Jack Fisher, seajnf@aol.com

The Benchmarking Working Group has prepared an update to their web page. The updated material will include: the benefits of benchmarking, a definition of the benchmarking process, the role of INCOSE in benchmarking, accomplishments, survey findings, plans for the future and a list of contacts. In addition, we have a draft for a follow-on survey on systems engineering. Our next objective is to install it on the web page for comments.

Highlights from the Test and Evaluation WG

Michelle Bailey, michelle_bailey@cl_63smtp_gw.chinalake.navy.mil

The Test and Evaluation WG hit the ground running for their kickoff meeting at the recent Symposium. Not only did we enroll nine members, but we actually had volunteers to write papers and seek out information! There seems to be a strong interest in Test and Evaluation and its role in system engineering. There also seems to be numerous opinions about the purpose of T&E, how it should be conducted, and by whom.

We will be examining the roles and responsibilities of Test and Evaluation from a systems engineering perspective. Questions to be discussed include: What are good T&E philosophies and policies? How should test requirements be defined? What should be tested, when, and how? What role should the test community play on the Integrated Product Team? How can we do better T&E planning? What role should modeling and simulation play in support of testing? Papers are planned to address these questions.

One paper will discuss the importance of having a systems engineering approach to T&E. Another will discuss the relationship between requirements and T&E. Other planned products include a handbook on T&E planning, a discussion of the roles of T&E throughout the product life cycle, and a discussion of the differences between DOD and industry test practices.

The group is looking forward to meeting again in January, and hammering out the answers to the above questions as well as adding new questions and products to the lists. For additional information, contact Don Greenlee at (619) 546-6508,don_greenlee@cpqm.saic.com or Michelle Bailey at (619) 553-9401.

The INCOSE Technical Community

September 1996

Education and Training Technical Committee
Create, coordinate, and disseminate the means to develop system engineers -- through undergraduate, graduate, focused, and on-the-job training. (John Velman, 310-364-6202, jrvelman @ccgate.hac.com; Joe Spigai, 301-985-7200, jspigai@aol.edu)

Academic Development Working Group
Define and develop methods and requirements necessary to educate system engineers in formal academic environments, and, in so doing, develop the system engineering academic models and standards that can be used as a guide for existing and developing formal academic programs at all levels. (Joe Spigai, 301-985-7200, jspigai@aol.edu)

Professional Development Working Group
Explore methods and requirements to train for systems engineering in professional environment. (Dick Phillips, 412-268-5877, dwp@sei.cmu.edu; Kevin Dutcher, 810-825-5635, dutcherk@gdls.com)

Systems Engineering Applications Technical Committee
Facilitate the formation and operation of working and interest groups whose purpose is to examine systems engineering within specific application domains and across domains. (Bill Schoening, 314-234-9651, ml38022 @SL1001.mdc.com; Bill Mackey, 301-794-1966, wmackey@cscgt.gsfc.nasa.gov)

Business Domain Analysis Working Group
Define business drivers and their relationships to their sectors. Translate this understanding into requirements for systems engineering and the priority of these requirements to internal INCOSE Working Groups. (Beth Clark, 303-541-8287, eaclark@uswest.com)

Application Forum Working Group
Facilitate the introduction and use of systems engineering principles, techniques, and practices to application domains in industry, government, and academia. (Bill Mackey, 301-794-1966, wmackey@cscgt.gsfc.nasa.gov; Carolyn Buford, 301-794-1946, cbuford@cscgt.gsfc. nasa,gov)

Facilities Systems Engineering Interest Group
Provide a forum to address the application of systems engineering within the facilities environment and articulate the value of systems engineering in terms of cost and time savings through achieving continuous improvement. (Bill Henderson, 615-454-5295, hendersonwf@hap.arnold.af.mil)

Measurement Technical Committee
Create, coordinate, and disseminate methods to measure systems engineering, including best examples of those measurements. (Rich Widmann, 310-616-7685, 0069222@msgate.emis.hac.com; Bill Miller, 201-386-5339, william.d.miller@att.com)

Benchmarking Working Group
Encourage and assist member organizations to participate in benchmarking and to use the results to improve the overall maturity of NCOSE systems engineering practices. (Jerry Fisher, 703-841-8824, gfisher@hq.caci. corn; Jack Fisher, 818-225-8710, seajnf@aol.com)

Best Practices Working Group
Collect and report on successful and innovative systems engineering practices. (Bruce Pittman, 408-354-3680, bpittman@scuacc.scu.edu)

Capability Assessment Working Group
Lead a broad-based INCOSE initiative to develop a method for assessing and improving the efficiency and effectiveness of systems engineering. (Blake Andrews, 319-295-4922, baandrews@crems.cca.rockwell.com; John Worl, 206-528-3219, worl@battelle.org; Don Barber, 602-436-3721, don.barber @cas.honeywell.com; Kerry Lunney, 612 805 5502, klunney @anet.rockwell.com; Richard Stevens, 44 1865 784 284, 100010.3303 compuserve.com; Ingvar Wilstrom, 46 (8) 782 4037, inwik@fc.sagus.se)

Metrics Working Group
Promote shared understanding of systems engineering metrics and measurement practices, and advance the state-of-the-art of metrics collection and utilization. (Donna Rhodes, 607-751-6102, donna.rhodes@lmco.com; Bill Miller, 201-386-5339, william.d.miller@att.com)

Modeling and Tools Technical Committee
Advance the state of the practice of systems engineering through the use of COTS tools and models. (Mark Sampson, 214-669-9937, sampson@sla te. td tech.com)

Information Model & Process Interest Group
Develop and disseminate executable representations of the systems engineering process, including schemes for tools integration. (Rick Steiner, 714-732-8312, steiner@igate1.hac. corn; T. J. Theodore, 214-669-9937, theodore@tdtech.com)

Model Driven System Design Working Group
Characterize model driven system design and identify transition strategies from present document driven approaches. (Byron Purves, 205-461-3413, robert.purves @msd.hsvl.hv.boeing.com; Loyd Baker, 205-837-5922, lbaker@vtcorp.com; Larry Permenter, 804-825-8533, permentl@hqaccdr.langley.af.mil)

Tools Database Working Group
Deliver a tools comparison / information database for general COTS systems engineering tools. (Bill McMullen, 214-575-7578, w-mcmullen@ti.com; Randy Case, 214-205-5306, rcase@esy. corn)

Tools Integration & Interoperability Working Group
Foster productivity and quality of systems engineering through integratedtools and environments. (Jim Schier, 703-631-2000, TNKB03E@prodigy.com; John Nallon, 214-669-9937, nallon@slate.tdtech.com)

Systems Engineering Management Technical Committee
Create, coordinate, and disseminate engineering management methods that apply to the definition, development, and support of systems. (Rick Harwell, 770-740- 0907, rharwell@mindspring.com; Heinz Stoewer, 49 2241 345940, 100746.1656@compuserve.com)

Requirements Working Group
To create a source for the best methodology for defining, communicating, and managing requirements. (Pradip Kar, 612-572-4722, pradip_kar@fmc.com; Mack Alford, 615-438-2807, alford@netcom.com; David Jones, 214-575-5453, daj2%mimi@magic.itg.ti.com)

Risk Management Working Group
Identify risk management tools and methods, process description, planning activities, literature sharing, best practices, lessons learned, and interfaces with related functions. (Larry Brekka, 703-845-3302, lbrekka@lan.mcl. bdm.com; Elaine Hall, 407-728-7475, drehall@aol.com)

Standards and Handbooks Working Group
Provide a focal point within INCOSE for: collecting and disseminating information on public and private sectors systems engineering related standards and handbooks; formulating, coordinating, and forwarding INCOSE positions and comments to originators of new/revised public and private sectors systems engineering related standards and handbooks; preparing and/or reviewing and making endorsement recommendations on standards and handbooks on the definition, understanding, and practice of World Class Systems Engineering. (Richard Schwadron, 314-232-6392, m169012@ws1951.mdc.com; John Marshall, 301-862-6040, 301-862-8140, marshallja%am3@mr.nawcad.navy.mil)

Systems Engineering Management Methodology Working Group
Create, coordinate, and disseminate process definitions and methods for planning, organizing, integrating, and controlling the technical aspects of a project throughout a system's life cycle. (Norm Cole, 208-524-1806, ncole@inel.gov; Tim Taylor, 508-845-8903, tgtaylo@sandia.gov)

Test and Evaluation Working Group
Promote all aspects of test and evaluation from a systems engineering perspective. (Don Greenlee, 619-546-6508, don_greenlee@cpqm.saic.com; Michelle Bailey, 619-939-6251, michelle_bailey@cl_63smtp_gw.chinalake.navy.mil)

Systems Engineering Processes & Methods Tech. Committee
Create, coordinate, and disseminate technical processes and methods used in the definition, development, and support of systems. (Dorothy McKinney, 301-640-3021, dorothy.mckinney@lmco.com; Dick Wray, 330-796-9931, rwray@ldsa.com)

Principles Working Group
Investigate the logical principles underlying top level system design and provide guidance in establishing boundaries, interfaces, and top-level system transfer functions. Create and disseminate standard definitions for key terms related to the practice of systems engineering. (Bill McCumber, 301-493 -1443, mccumber@aol.com; Sten Dahlberg, 206-657-1676, dahlbergs@net.al.boeing.com)

SE Process Working Group
Refine a description of systems engineering elements and their interactions that is useful to practicing system engineers and requirements for benchmarks, methods and techniques for implementing the systems engineering process. (Bob Olson, 619-927-1653, bob_olson@imdgw.chinalake.navy.mil; Dick Wray, 330-796-9931, rwray@ldsa.com; John Snoderly, 703-805-5258, snoderlyj@dsmc.dsm.mil)

Systems Architecture Working Group
Determine processes, methods, and enabling technologies to develop practical systems architectures that will satisfy user needs. (Kent A. Johnson, 703-404-9769, k.johnson@ieee.org; Chander Ramchandani, 301-794-2439, cramchandani@cscgt.gsfc.nasa.gov; Timothy B. Smith, 214-205-4209, SMITHTB@aol.com; Bill Gess, 714-732-2712, whessjr@msmail2.hac.com)

INCOSE Technical Board
Chair: Brian McCay, 617-229-5329, bmccay@concept5.com
- Technical Committee Members:

John Velman, Education and *Training Technical* Committee;
Bill Schoening, Systems Engineering *Applications;*
- Technical Committee:

Rich Widmann, *Measurement Technical Committee;*
Mark Sampson, *Modeling and Tools Technical Committee;*
Rick Harwell, Systems *Engineering Management Tech. Committee;*
Dorothy McKinney, *Processes and Methods Technical Committee*
- Board of Director Representatives:

Jerry Lake, 703-751-7987, lakejg@smisyseng.com
Rich Mintz, 206-957-4220, rmintz@scitor.com

CHAPTER NEWS

ON THE HOME FRONT

Ken Kepchar, kkepchar@mdc.com

The combined Membership & Chapters committee met in Boston amidst the 1996 symposium. A lively discussion on issues, and a meaningful exchange of information between the chapter representatives ensued. All five regions were well represented, along with Canada, Australia, and several European countries.

There was a noticeable increase of interest in forming new chapters, especially on the international front. To support participation outside of the USA, the INCOSE Board formally recognized Region VI. The committee held a session to discuss the guidelines for new chapter formation, and is updating the Chapter Startup kit (Liberty/Texas Gulf Coast Chapters). Lew Lee (San Francisco) and I anticipate explosive international membership growth over the next two years.

The focus in previous committee meetings had been on resolution of issues, but there was a noticeable shift in Boston toward a positive exchange of information on a chapter-to-chapter basis. Several program suggestions (and even a video tape example) of successful chapter programs were offered for use by other chapters. Ron Olson (olson@mtv.gtegsc.com) briefed the committee on the results of the recent technical products survey; and then solicited comments. Lew Lee offered some lessons learned on the management of tutorials. John Clouet (Las Vegas) gave an insightful presentation on the care and feeding of the highly successful Region II conference held in April.

Ginny Lentz led the discussion on the issues and concerns from existing chapters. This discussion focused on the need to attract new membership, provide increased value to our present membership, and develop a pool of quality material for use by the chapters. Ginny took the opportunity to share her expectations from the chapters for supporting goals of the INCOSE through the end of the decade, namely:

- regional conferences (more and higher quality over time) to be run on a positive net revenue basis for the chapter(s) involved,
- product ownership, e.g. products such as tutorials, educational material, etc.

STATUS of CHAPTERS' PROJECTS

- Leadership Handbook (NorthStar Chapter) – a draft was furnished for distribution to the committee for review and comment. The financial portion of the handbook will be authored and coordinated by the Seattle chapter.
- Conference Organizer's Handbook (Las Vegas Chapter) – John Clouet presented a set of lessons learned that will form the basis for this handbook. The San Francisco chapter will be responsible for the tutorial portion of the handbook in conjunction with Seattle. The 3rd section will be on tips and techniques for running programs at a local level (assignment yet to be determined).
- Videotape on the value of system engineering – North Texas and Space Coast chapters are jointly exploring the feasibility of producing an educational video to be used by the chapters for both individual and corporate recruiting. If you have any suggestions, or wish to contribute to this project, please, contact Jim Stehn (North Texas) or Tom Palmer (Space Coast).

Colorado

Christopher J. Esch, Denver area director, cesch@infoburst.com

The Colorado Chapter is planning an active year for 1996-1997. Elections were held in May, and new board members for the chapter were installed by INCOSE President Ginny Lentz. Area directors were added to the board to represent the interests of Colorado's three major engineering centers: Denver, Boulder, and Colorado Springs.

Led by President David Hottman, the Colorado Chapter board of directors held several meetings to plan events for 1996-1997. "Increasing membership and providing value to existing members are the key goals for this year," says Hottman. "We will hold half of our meetings in Denver and the other half in either Boulder or Colorado Springs to make it easier for those outside Denver to participate."

The board is actively booking guest speakers for each meeting, covering both commercial and DoD oriented systems engineering topics. The Colorado chapter held a special kick-off meeting in September at the Embassy suites in Denver. Guest speaker Erik Stein, of TRW, presented an overview of object-oriented analysis and design in systems engineering. A tutorial series is also planned beginning with a software-, requirements tutorial in October. Two additional tutorials are planned for 1997.

In other chapter news, seven members from the Colorado chapter held a chapter luncheon at the international INCOSE conference in Boston last July.

SF Bay Area Chapter Report

Jim Whalen, jim_whalen@smtp.svl.trw.com

Our chapter made significant contributions to the INCOSE during 1996. In April, many SF Bay Area Chapter members traveled to Las Vegas for the Region II conference to present papers, participate in panel discussions, and take part in lively technical interchanges. Then at the INCOSE Symposium, we had good attendance from the chapter, several excellent paper presentations by chapter members, participation by members in several panel discussions, and strong representation in the INCOSE administrative and technical working groups. A major contribution to working groups from our chapter was a draft of the System Engineering Handbook. Many of our members contributed to this draft, and Tim Robertson deserves special congratulations for putting together this excellent document. The document was submitted to the technical working groups for review.

Copies of the System Engineering Handbook have been distributed to interested local chapter members to obtain their review comments. Again, Tim has agreed to lead an update in the November time frame. The goal is to make that update a "final product."

Our monthly programs and our tutorial programs continue to be very successful. Our membership figures and attendance are the true measures of our successes.

So far this year we have had three excellent tutorials: Ivy Hooks' requirements writing tutorial in March, Dorothy McKinney's software and requirements presentation in May, and Barbara and Kris Bicknells' Quality Function Deployment in July. We are planning one or two more tutorials before the end of the year. Barney Morais oversees our tutorial programs.

Sue Shreve and Lew Lee have done a great job in setting up monthly programs. We have a growing library of videotapes from these monthly meetings, and Hugh Calvin manages this popular resource. To learn more about the chapter's activities, drop in our web page at http://www.relay.net/~lew/sfbac.html.

The Systems Engineering Society of Australia (SESA).

Herve Rochecouste, National President,
herve_rochecouste@ieaust.org.au

SESA is a Technical Society of the Institution of Engineers, Australia (the IEAust), and is affiliated with INCOSE. The affiliation terms mean that SESA "looks" like a single international Chapter of INCOSE, but manages its own internal affairs and membership administration. SESA members do not enjoy the same voting rights and other specific US services applicable to INCOSE members.

SESA currently has 201 members in four regional chapters (Sydney, Canberra, Melbourne and Adelaide), a few "unattached" members in Brisbane, and one in Singapore. SESA was formed in 1994 and promotes a mission similar to that of INCOSE. Australians have been attending and presenting at INCOSE symposium since 1992, and have consistently been the largest international delegation. In July 1996, thirteen SESA members attended the Boston Symposium.

In October SESA will hold its 3rd annual symposium (Melbourne). Previous symposia were held in Canberra ('94) and Sydney ('95). The 1996 Symposium focuses on Tutorials and Tools exhibits. Earlier this year SESA held a successful Defence Industries Workshop, and also published its first Journal. SESA communicates with its members through quarterly newsletters and an Email reflector. Local chapters hold monthly meetings and working groups sessions. SESA is currently negotiating to hold the INCOSE Symposium in Australia for the year 2000; if the plan goes ahead, the event might coincide with the Sydney 2000 Olympic Games.

Inland Empire Chapter (IEC),

Petrus Kaufman, Petrus.Kaufman@qmgate.trw.com

The Inland Empire Chapter in San Bernardino, Calif., in cooperation with the University of California Extension in Riverside, Calif. (UCR), has sponsored the following Systems Engineering courses:

12 - 26 September 96, **"Systems Engineering Management,"** Tuesday / Thursdays, 6-9:30 p.m., Fee: $180.

This course is an introduction to Systems Engineering, beginning with the basics, and the need for such a methodology; the entire process including foundation concepts is explored.

1 Oct - 1Dec 96, **"Concept Development,"** **Tuesdays,** 6:30 - 9:30 p.m., Fee: $230.

The Concept development and selection stage is the best time to examine viable alternatives. This course develops understanding of the methodology for transforming the need / vision of a customer into realistic concepts.

For information about upcoming courses contact UCR Extension Center at (909) 787-4105, or toll free (800) 442-4990.

The Inland Empire Chapter in Calif. will co-hosting the 1997 Winter Workshop to be held by the Silver State Chapter, at Vacation Village, Las Vegas. This will be on January 27 - 30, 1997, and is by invitation only.

WMA Chapter Report

Sarah Sheard, sheard@software.org

The Washington Metro Area chapter membership increased 37 percent in four months. We attribute this to the following factors:

1. increasing advertisement of INCOSE and the chapter, including announcing chapter meetings in weekly and monthly technical and business publications and on the Web, among other places, and by attending job fairs armed with INCOSE products and chapter information,
2. Producing interesting programs consistent with our 1996 goals, which include meeting expressed member needs and broadening our appeal outside the defense/aerospace arena. Some of our recent programs included "Systems Engineering" at Bell Atlantic (the local phone company), "Achieving SEI CMM Level 4," and "Business Process Reengineering," which not only took top marks in our membership interest survey but also had broad appeal.
3. Offering free meals to first time guests: "Try before you buy." We recommend chapters who adopt this idea insist on these guests filling out forms of contact and company information. We started this in August, but wish we had started earlier.
4. A vigorous effort to greet and follow-up on first-time attendees, including a letter welcoming them and explaining the benefits of INCOSE and chapter membership.

Future WMA programs include student presentations from George Mason University's Systems Engineering department (September) and "Systems Engineering Metrics" by Cathy Tilton (October). Also, in late October or early November, we will bring Dr. Mark Maier from Alabama to present our second Saturday tutorial, based on his Systems Architecting and Modeling tutorial at the Boston symposium.

The Netherlands Chapter of INCOSE

President Cheryl Atkinson, contact Secretariat: NL-Chapter INCOSE, Doelstraat 12, 2011 XA Haarlem, The Netherlands, E-mail: jgp@knoware.nl (Graham Pascoe)

The chapter is primarily aimed at professionals in the Netherlands. We actively want to cooperate with other European chapters, and our membership is open to persons from other countries, in particular from N.W. Europe.

The chapter is an organization formed to develop, nurture and enhance the systems engineering approach to multi-disciplinary system product development.

Operational objective for our members is to promote the interests of the members on the basis of shared involvement with and interest in Systems Engineering:

- support each other in obtaining and/or developing knowledge and practice relating to SE;
- promote the application of SE in the Dutch market;
- assist each other in the market for SE;
- exchange knowledge, practice and experience with sister organizations.

History and incorporation: The idea of forming a local chapter was first circulated amongst a group of potentially interested persons in the beginning of 1996. Prime mover was our current president, Cheryl Atkinson, who felt that SE represented a valuable capability that had been built up in the Netherlands, but was in danger of dissipating away if nothing was explicitly done to hold it together. Enough people were sufficiently enthousiastic that the idea seemed viable.

After a couple of preparatory meetings the first formal gathering of the Netherlands chapter was held on April 25, 1996 in offices overlooking the restoration work being done in the hangar of the Dutch Dakota Association. (The Dakota is known in some parts of the world as the Douglas DC-3!) Most of the current members work in the aerospace industry, but we are actively recruiting members from other fields.

The chapter currently has 30 paid-up members (including 1 student member and one corporate member). We are aiming for 100 members, 25 student members, and 25 corporate members within two years. We don't underestimate the hard work that will be required of us all if we are to achieve that goal.

Chapter Officers: President: Cheryl Atkinson
Secretary: Reinier Quast
Treasurer: Graham Pascoe

The chapter is primarily a group for and by the members. We have active groups working on the following topics:

- Recruiting and Membership;
- Chapter handbook;
- Newsletter.

It is our intention to start up additional groups concerned with the content of System Engineering as soon as possible.

The chapter meets formally 4 times a year. Upcoming meetings are on October 3, 1996 and December 12, 1996. At each meeting there is, in addition to the formal business of chapter affairs, a keynote speaker on a topic relevant to SE, and plenty of opportunity for informal interchange between the members. We are bracing ourselves for the idea of arranging a symposium in the third quarter of 1997, preferably in cooperation with one or more sister chapters, and/or organizations from fields related to Systems Engineering.

We look forward to hearing from interested persons!

Los Angeles Chapter

Francis Thompson, president,

(coming)
1997 **Symposium Marketing Plan**
plans for 1996-1997

Texas Gulf Coast

Bob McCormick, rmccormi@ghgcorp.com

TGCC is on the Internet! We currently have an INCOSE-TGCC home page, which is sporting our very own TGCC logo! The TGCC "home page" can be found at http://www.ghgcorp.com/rmccormi/tgcc/tgcc.htm, as well as through the INCOSE home page. For those of you with internet access, check it out!

In addition, we are still looking for help to develop our TGCC newsletter, "Focus on Systems Engineering". Volunteers should contact Bob McCormick at (713) 483-5900, or via e-mail at RMCCORMI@GHGCORP.COM.

Central Arizona

Jack Ring, jring@amug.org

The Central Arizona chapter is back, thanks to Wayne Wymore's initiative, and is looking forward to a great year under the leadership of our new Interim President, Madeleine Engstrom.

Interim officers are Don Fowler, President Elect, and Ronald Thruston, Treasurer. Gretchen Beers was elected Secretary but job duties have taken her out of town. (We miss you, Gretchen.) Directors at Large are George Anderson, George Muncaster and Jack Ring. In addition to restarting the Chapter, we are submitting Annual Reports for 1994, and 1995 to satisfy the State of Arizona and revising the Constitution and By Laws. Any advice or draft documents from other chapters would be greatly appreciated.

Chapter meetings in April, May, June and August drew 15 to 22 attendees out of the 42 affiliated members. We skipped July for the INCOSE conference. Speakers have been Jim Brill on Integrated Product Development, Jim Cantrell on user experiences with RDD-100 and Jack Ring on the Possibilities for Improved Systems Engineering. In August, Madeleine, Ron and Jack reported on the impressive Silver State Mini-Conference in LasVegas. Next, George Anderson will report on the INCOSE '96 Conference. Meetings are the second Wednesday of the month. Out of town visitors are welcome. Please come and share your experiences.

We regretfully had to decline to host the Fall '96 mini-conference because we are just getting re-started but we hope to give many of you a reason to enjoy the Valley of the Sun, soon.

We appreciate Lew Lee's email and invite any other chapter to communicate with us. Almost all of our associates are on email.

The University of Alabama in Huntsville

The Department of Industrial and Systems Engineering (ISE) is pleased to announce the funding of an **Eminent Scholar in System Engineering and Simulation** under the State of Alabama's Eminent Scholar Program. Applications for this position are being accepted. The successful candidate will have published extensively (including books) and secured and performed funded research including applications which are defense/aerospace system based in: 1) systems engineering with an emphasis on systems analysis, and 2) simulation. The duties will include securing and performing funded research, interacting proactively with the local and national technical and professional Systems Engineering community, teaching in the ISE graduate and undergraduate programs, and serving as a mentor to both students and junior faculty in the Department. The individual selected shall have a Ph.D. in Industrial or Systems Engineering, an undergraduate degree in Engineering (or P.E. license), a national reputation in systems engineering, a record of achievement commensurate with appointment as a tenured full professor, and be eligible to participate in classified research. Of special interest is the candidate's ability to perform research and provide instruction involving the integration of best commercial practices into defense/aerospace applications.

The Department of Industrial and Systems Engineering consists of 10 faculty members. The Department participants in the BSE, MSE, MSOR, and Ph.D. degree programs. The six ISE graduate degree options are Systems Engineering, Engineering Management, Quality Engineering, Manufacturing Systems, Operations Research, and Systems Simulation Engineering. The Department has a large nontraditional student body including 55 undergraduates and over 200 graduate students. The College and Department have strong ties to the defense and aerospace communities (i.e., NASA and DOD) and to the commercial sector.

The University of Alabama in Huntsville enrolls approximately 7,200 students in five colleges and during 1995-96 participated in contract and grant expenditures in excess of $30 million. The University is located in Huntsville, Alabama, a cosmopolitan city of 171,000.

Applications should include resume, citizenship status, and the name, address, and telephone number of five professional references. Send to:

Dr. Richard. M. Wyskida
ISE Eminent Scholar Search Committee Chair
Industrial and System Engineering Department
The University of Alabama in Huntsville
Huntsville, AL 35899

Review of applications will begin November 8, 1996, with the position expected to be filled by Fall Semester, 1997. UAH is an equal opportunity/affirmative action institution.

INCOSE Local Chapters and Contacts

Region	Chapter Name	City, State or Country	Contact	Email	Phone	Fax
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II	Southern Arizona	Tucson, AZ	Harry Goodkin	hsgoodkin@ccgate.hac.com	520-663-6751	
	Inland Empire	San Bernadino, CA	Chuck Kondrack	chuck.kondrack@trw.com	909-383-3887	909-383-3846
	Los Angeles Area	Los Angeles, CA Orange County Ventura	Susan Jones	susan.jones@aero.org.	310-336-8576	310-336-5581
	San Diego	San Diego, CA	Ernesto Amaro	ernesto_amaro@qmail.laguna sparta.com		
	San Francisco Bay Area	San Jose, CA	Jim Whalen	jim_whalen@smtp.svl.trw.com	408-743-6121	408-743-6114
	Silver State	Las Vegas, NV	John Clouet	john_clouet@notes.ymp.gov	702-295-9144	702-794-7445
	Central Arizona*	Phoenix, AZ	Jack Sivak	jacksivak@aol.com	602-585-6849	602-585-7726
	Salt Lake Valley*	Utah	Harlan Reed	reed_harland@out. trw.com	801-774-2750	801-774-7930
III	Metro Denver	Denver, CO	Beth Clark	eaclark@uswest.com	303-541-8287	
	North Star	Minneapolis, MN	Dave Walden	david.d.walden@cdev.com	612-921-6469	612-921-6869
	Midwest Gateway	St. Louis, MO	Ken Kepchar	kkepchar@gwsmtp01.mdc.com gkkep@inlink.com	314-234-8156	314-233-0303
	North Texas	Dallas / Ft. Worth, TX	Randall Case	rcase@esy.com randy_case@nkn.net	214-205-5306	214-205-4689
	Texas Gulf Coast	Houston, TX	Jonette Stecklein	jsteckle@ssf2.jsc.nasa.gov	713-244-7146	713-244-8108
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IV	New England	Boston, MA	Pat Hale	halep@eng1.otis.utc.com pat_hale@msn.com	860-676-5250	860-676-6850
	Tri-State	Detroit, MI	Dan McClure	Inustruk.gzjhbr@gmeds.com dmcclure@msmail3.hac.com	810-375-5307	810-375-2346
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	Illinois*	Illinois	Dave Sea ton	seaton@tellabs.com	708-512-7935	708-512-7098
	New York State*	New York	Darryl Mounts	d.mount@ieee.org	716-726-4168	716-726-2851
	NE Ohio*	Ohio	Bob Bodi	bobbodi@aol.com	216-228-0545	216-228-6729
	Dayton*	Dayton, OH	Edward Pohl, PhD	epohl@afit.af.mil	513-255-6565	513-476-7621
	Delaware Valley*	Pennsylvania	Richard Pariseau	pariseau@nadc.navy.mil	215-441-3342	215-441-2562

(* Emerging Chapters)

Region	Chapter Name	City, State or Country	Contact	Email	Phone	Fax
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	Washington Metro	Wash, D.C.	Art Pyster	pyster@software.org	703-742-8877	703-742-7200
	Space Coast	Melbourne, FL	Sam Harbaugh	harbaugh@acusys.com		
	Central Florida	Orlando, FL	Tom Remenick	tom_remenick@ccmail.orl.mmc	407-826-1777	407-826-1581
	Chesapeake	Baltimore, MD	Mark Walker	Imwalker@tasc.com Imwalker@sun.aitc.rest.tasc.com	410-850-0070 X2057	410-850-0404
	Atlanta*	Atlanta, GA	Dan Garvin	garvind@aol.com dclown@aol.com	404-818-8658	404-818-8100
	North Carolina*	Raleigh, NC	Kip Klish	klish@aurxce.aur.alcatel.com	919-850-5114	919-850-5588
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	Southern Virginia*	Virginia	Wolt Fabrycky	fabrycky@vtvml.cc.vt.edu	703-231-6147	
INTERNATIONAL	Vancouver*	Vancouver, Canada	Jas Madhur	jwm@mda.ca	604-231-3086	604-278-5625
	Montreal'	Montreal, Canada	Michel Lavigne	miavigne@oerlikon.ca	514-358-2000	514-358-1744
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	Holland	Schiphol, Netherlands	Cheryl Atkinson		31-20-605-3725	3120 605-4940
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	Australia**	Australia	Herve Rochecouste	rochecou@spf15m.jorn.gov.au	613-541-6901	613-543-3338

(* Emerging Chapters ** Affiliation)

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Providing a complimentary copy of ***INSIGHT*** to potential members is a great way to introduce then to your chapter and the organization. For extra copies, contact the Central Office:

INCOSE
2033 Sixth Avenue, Suite 804
Seattle, WA 98121

Phone: (800) 366-1164
Email: incose@halcyon.com
Fax: (206) 441-8262

CALENDAR OF EVENTS

October

1 Oct - 1 Dec 96 – Inland Empire Chapter (IEC)
Topic: Concept Development course sponsored by the Inland Empire Chapter (IEC), San Bernardino, CA in cooperation with the University of California Extension Riverside CA. (UCR).
Time / Place: Tuesdays, 6:30 - 9:30 p.m., Fee: $230.
For information contact UCR Extension Center at (909) 787-4105, or toll free (800) 442-4990.

8 – WMA Chapter Meeting.
Topic: Systems Engineering Metrics, Cathy Tilton
Time / Place: Boeing Conference Center, Tycon Tower, Tyson's Comer, VA. 6:30 PM for a light dinner, $8 members, $10 nonmembers. Reservations requested to Abe Meilich, (703) 913-1505, 1 week prior.

8 – SF Bay Area Chapter Monthly Meeting.
Topic: Possible talk on airline safety and its challenges to systems engineers.
Time / Place: Contact Sue Shreve for information (sshreve@us.oracle.com, 415-506-6398)

14 – LA Chapter
Topic: Committee Meeting Night.
Time / Place: 6:00 -8:00 pm at The Aerospace Corporation, 200 N. Aviation Blvd, El Segundo.
Contact: Susan Jones, (310) 336-8576.

16 – Chesapeake Chapter
Topic: Working / Interest Group Meetings.
Time / Place: Dinner - 6:00 PM, Meeting - 6:30PM. Johns Hopkins University Applied Physics Laboratory, Columbia, MD.
Contact: Don Kauffman, (410) 583-4130, kauffman@ascs.aro.alliedcorn, or Joe Spigai, (301) 649-4583, jspigai@aol.com.

21 – LA Chapter
Topic: Symposium Planning Meeting
Time / Place: 6:00 - 8:00 pm at Barnaby's in Manhattan Beach.
Contact: Judith Peach, (310) 336-8243.

Oct 26 or Nov 2 (date to be *resolved*)– WMA Chapter
Topic: Tutorial Systems Architecting, Dr. Mark Maier.
Contact: Abe Meilich, (703) 913-1505.

November

11 – LA Chapter
Topic: Speaker Meeting, (topic TBD)
Time / Place: 6:00 - 8:00 pm. Location TBD.
Contact: Dr. Robert Shishko, (818)354-1282.

12 – WMA Chapter Meeting
Topic: Topic and speaker TBD.
Time / Place: 6:30 PM for a light dinner, $8 members, $10 nonmembers, Boeing Conference Center, Tycon Tower, Tyson's Comer, VA. Reservations requested to Abe Meilich, (703) 913-1505, 1 week prior.

November (continued)

18 - LA Chapter
Topic: Symposium Planning Meeting
Time / Place 6:00 - 8:00 pm at Barnaby's in Manhattan Beach.
Contact: Judith Peach, (310) 336-8243.

20 – Chesapeake Chapter Meeting
Topic: Topic TBD.
Time / Place: Dinner - 6:00 PM, Meeting-6:30PM. Johns Hopkins University Applied Physics Laboratory, Columbia, MD.
Contact: Don Kauffman, (410) 583-4130, kauffman@ascs.aro.allied.com, or Joe Spigai, (301) 649-4583, jspigai@aol.com

December

9 – LA Chapter
Topic: Committee Meeting Night
Time / Place: 6:00 -8:00 pm at The Aerospace Corporation, 200 N. Aviation Blvd, El Segundo.
Contact: Susan Jones, (310) 336-8576.

16 – LA Chapter
Topic: Symposium Planning Meeting.
Time / Place: 6:00 - 8:00 pm at Barnaby's in Manhattan Beach.
Contact: Judith Peach, (310) 336-8243.

18 – Chesapeake Chapter
Topic: Working / Interest Group Meetings.
Time / Place: Dinner-6:00 PM, Meeting-6:30PM. Johns Hopkins University Applied Physics Laboratory, Columbia, MD.
Contact: Don Kauffman, (410) 583-4130, kauffman@ascs.aro.alliedcorn, or Joe Spigai, (301) 649-4583, jspigai@aol.com.

January 1997

6 – LA Chapter
Topic: Speaker Meeting (topic TBD)
Time / Place: 6:00 - 8:00 pm. Location TBD
Contact: Dr. Robert Shishko, (818)354-1282

13 – LA Chapter
Topic: Symposium Planning Meeting
Time / Place: 6:00 - 8:00 pm at Barnaby's in Manhattan Beach.
Contact: Judith Peach, (310) 336-8243.

14 – WMA Chapter Meeting
Topic: Topic / speaker TBD
Time / Place: 6:30 PM for a light dinner, Cost has changed to $10 for non members, $8 for members, free for first-time guests, Boeing Conference Center, Tycon Tower, Tyson's Corner, VA Reservations requested to Abe Meilich, (703) 913-1505, 1 week prior.

27-30 INCOSE Winter Workshop* Las Vegas, Nevada. Inland Empire Chapter (EIC) CA will be co-hosting the 1997 Winter Workshop held by the Silver State Chapter, at Vacation Village Las Vegas. Invitation only.

INCOSE Infrastructure

Internal Control Review Gives INCOSE Good News, Advice

Dorothy Kuhn, Director - Region III, kuhnd@ti.com

In the second quarter of this year, INCOSE retained the accounting firm of Pratt & Chew to conduct a financial management review of INCOSE's internal control procedures. Such periodic reviews are helpful; this one follows a 1995 financial audit, which was conducted at the time our central office was moved to the firm of Shirley Bishop, Incorporated.

The firm was chosen to satisfy several requirements: proximity to Shirley Bishop's office, no previous business with Shirley Bishop's office, experience with non-profit organizations, experience with cash-based accounting, experience with financial management / internal control reviews, and ability to conduct the review in the second quarter. Pratt & Chew satisfied all these and could do e-mail!

The goal of an organization's internal control structure is "to provide reasonable, but not absolute, assurance that financial data are recorded, processed, summarized, and reported consistent with the assertions embodied in the financial statements." All quotes from Pratt & Chew final report.

Pratt & Chew did find some opportunities to "strengthen the Organization's internal control structure." Their strongest recommendation was "to implement a process of regular financial reporting of actual results together with appropriate budget information. We specifically recommend that a statement of assets, liabilities and net worth, and a statement of cash receipts and disbursements be prepared by the Managing Executive at least quarterly, and preferably monthly." Pratt & Chew provided INCOSE a recommended format and detailed advise.

Other recommendations include:

- Treasurer to reconcile the bank accounts
- Investing Excess Funds
- Including the financial activities of chapters with INCOSE s annual filing of Form 990
- Keep copies of checks received in the mail

Beginning with the third quarter of this year, INCOSE is conducting its financial business in accordance with the Pratt & Chew recommendations.

Pratt & Chew closed their final report by noting that "there are many other procedures that could be implemented in order to further strengthen the internal control structure... However, due the size of the Organization, we believe implementation of such procedures may be cumbersome, lead to a significant slowdown in the processing of transactions, and may not provide that much additional assurance that activities are being properly carried out. We believe that our recommendations above can result in a significant strengthening of the internal control structure at a modest cost." This is the risk-assurance balance that generally suits non-profit organizations.

The nature of non-profit financial control was summarized as "generally not conducive to a strong control environment. Limited staff, budget constraints and a mixture of volunteers and paid staff lead to real difficulties in trying to separate duties and responsibilities. As discussed above, a very effective tool the Board and management can utilize in assuring that the activities of the Organization are carried out properly is a budget."

The Board of Directors is committed to developing good budgets and to properly monitor and control them. We recognize the trust that INCOSE members have put in us, and will do our best to be good stewards of both your trust and INCOSE's funds.

INCOSE **Officers**

- President

Ginny Lentz, (860) 727-7301, lentzva@utrc.utc.com

- Past President

Jim Brill, (408) 372-2473, jbrill@mbay.net

- President Elect

Eric Honour, (407) 242-5192, ehonour@iu.net

- Treasurer

Mike Wood, (206) 657-2565, woodm@net.a1.boeing.com

- Secretary

Joe Defoe, (301) 240-5721, joe.defoe@lmco.com

- Ways and Means

Art Morrison, (206) 657-5703, morrisona@al.boeing.com

Industry Briefs

Professional Agreement With EIA

bmccay@concept5.com

INCOSE has reached a Professional Agreement with the Electronics Industry Association (EIA). This agreement promotes systems engineering and related professional areas of mutual interest and benefit. The scope of the agreement includes information exchange, joint projects and standards development. As part of standards development, INCOSE will be invited to be joint authors on all systems engineering related standards work, including ANSI standards. INCOSE will enjoy co-authorship, while its members will be able to purchase co-authored documents at the same discount price as EIA members. Currently, INCOSE is working closely with EIA on two standards efforts (see article on Technical Community): the EIA 632 Standard: Process for Engineering a System and the EIA Systems Engineering Capability Model Working Group.

INCOSE is actively seeking additional professional agreements with sister systems engineering organizations. If you have any recommendations regarding specific organizations and/or points of contact, please contact Technical Board Chair, Brian McCay at (617) 229-5329 or at bmccay@concept5.com.

Third Annual Workshop on Engineering of Systems in the 21st Century: Facing the Challenge (WES 21)

The Third Annual Workshop on Engineering of Systems in the 21st Century: Facing the Challenge (WES 21) will be held October 30 - November 1, 1996 at The Inn and Conference Center at the University of Maryland University College, College Park, Maryland. The invitation-only Workshop, co-sponsored by the Office of Naval Research and the Naval Surface Warfare Center, is hosted by the Naval Surface Warfare Center's Dahlgren Division (NSWCDD). WES 21 brings together systems engineers, program managers and technologists from industry, all branches of the Department of Defense (DoD), government laboratories and academic institutions to explore solutions to the challenges facing those responsible for engineering complex systems in the decade ahead.

Initiated in 1994, WES 21 is aimed at guaranteeing that the technical community maintains its capability to architect, engineer and produce major systems like the Space Shuttle, the AEGIS Cruiser and the F-22 Fighter, all complex mixes of hardware, software and human resources. The goal of the workshop has been to establish a collaborative dialogue between government, industry, and academia in identifying needs for improvement to the processes, methods, tools, and environments associated with engineering complex systems. The results of the previous two workshops have been broadly distributed within the systems engineering community and used to support research and technology initiatives within DoD and industry. The WES 21 Steering Committee, consisting of representatives from related technical societies and associations, provides guidance for WES 21 in its efforts to reach out to the broad technical community and in developing its investment strategies. The members of the committee are listed in Table 1.

Table 1 WES 21 Steering Committee

Bruce Pittman American Institute of Aeronautics and Astronautics
Dr. Milt Franke American Society of Mechanical Engineers
Dr. Alfred Skolnick American Society of Naval Engineers
Dr. Jude Franklin Electronic Industries Association
Dr. Alex Stoyenko IEEE
Dr. Stephanie White IEEE Engineering of Computer Based Systems Task Force
Mr. Eric Honour International Council on Systems Engineering
Mr. Jim O'Brien National Security Industrial Association
Dr. Dinesh Verma Society of Logistics Engineers

The emphasis on Integrated Product and Process Development (IPPD) and Integrated Product Teams (IPT) throughout DoD highlights the increased importance being placed on producing quality systems and products despite schedule and fiscal constraints. Given this interest, this year's topic is the use of IPPD and IPTs, with a special focus on establishing requirements for science and technology initiatives which can enhance development of complex systems using IPPD. This year's participants will include a wide array of skills and experiences including participation in an IPPD environment or on an Integrated Product Team; knowledge of battle space integration/interoperability issues; major responsibility in a program office develop-

ing complex systems such as ships, submarines or aircraft; or involvement with Cost and Operational Effectiveness Analyses (COEA). It is hoped that this intensive, hands-on workshop will result in products or processes that may used to enhance implementation of IPPD on major projects. For more information, visit the WES 21 World Wide Web site at http://www_ecs.nswc.navy.mil/~wes21. Inquiries should be directed by E-mail to Dr. Harry Crisp, Naval Surface Warfare Center Dahlgren Division, hcrisp@nswc.navy.mil; or by mail to WES 21, P.O. Box 6881, Arlington, VA 22206.

MERIT - Mission Environmental Requirements Integration Technology

William L. McMullen, w-mcmullen@ti.com

MERIT is a Windows-based tool being developed by the USAF's Wright Laboratories. The MERIT objectives include:

1. Requirements Analysis: Integrate operational and logistics profiles with knowledge based engineering to predict realistic life cycle environments during concept exploration.
2. Decision Support: Quantify the impact of logistics plan and weapon employment alternatives on engineering requirements. Quantify impact of change in engineering requirements on operational capabilities (availability).

The concept is to leverage world wide environmental knowledge, life cycle definitions, and environmental predictions to output realistic life cycle and environmental profiles which can be:

- a basis for design and test requirements
- parameter definition for performance simulations
- load inputs for durability and life analysis

Candidate scenarios for using MERIT are cost analysis/control for proposals and new programs; cost avoidance on Pre-Planned Product Improvement programs; and cost avoidance for engineering changes and warranties on fielded systems.

Additional information on MERIT can be found at URL: http://134.131.29.101/merit.htm , or by contacting me.

INCOSE **Interview**

Mark Maier

Conducted by Beth Clark, eaclark@uswest.com

Mark Maier is the author of "Architecting Principles for a System-of-Systems." He is an Assistant Professor of Electrical and Computer Engineering at the University of Alabama in Huntsville. His research is divided between signal processing (principally stereoscopic image compression and radar detection) and system architecting. He is the coauthor, with Dr. Eberhardt Rechtin, of "The Art of Systems Architecting." He has thirteen years experience in complex system development in both industry and academia. Before coming to the University he was with Hughes Aircraft in Los Angeles where he worked in signal processing algorithm development and system concept development on a variety of military and commercial systems. Maier received a B.S. and M.S. in engineering from the California Institute of Technology and a Ph.D. in Electrical Engineering from the University of Southern California. He is a member of the IEEE and the International Council on Systems Engineering. Following is an on-line interview conducted by Beth Clark, INCOSE Communications Committee.

Beth: You are the author of "Architecting Principles for a System-of-Systems," as well as an soon-to-be published book with Eberhardt Rechtin entitled "The Art of Systems Architecting." How did you develop an interest in systems architecting?

Mark: Largely by chance. My PhD advisor told me this guy from industry was going to start a new course that might be interested to somebody with broad interests and that I might want to take it. So I did, and was immediately fascinated. I think doing a series of case studies for the course on notably successful systems was particularly important to solidifying my interest. On taking the course I realized I had been interested in architecture for many years, I just didn't know what to call it.

Beth: Your book is called "The Art of Systems Architecting." Please explain why you feel systems architecting is an art, rather than a science or discipline.

Mark: Actually, I think architecting (and engineering) are both art and science. "Art" emphasizes the heuristic and synthetic aspects. We don't want to minimize the science, only emphasize what we think of as more neglected. Too often, I think, engineers try and find a analytical and "optimal" solution to any problem, regardless of whether or not the framework needed to make it analytical suppresses important parts of the problem.

Beth: Which heuristics do you feel are most critical to the architectural process?

Mark: Architects seem to choose their own set based on the nature of problems in their domains. What might be critical heuristics in one field might not be so critical in another. Perhaps more important, the way a given heuristic applies may specific to a given field. In general, though, I think heuristics on partitioning, maintaining simplicity, and assessing business position have the widest applicability.

Beth: How do you relax and forget about systems architecting?

Mark: **You** mean there is life outside of work? Seriously, though, I also have students doing real work in system development. I'm advising a group of students trying to build a satellite, and have other students building computer visulization technologies. For a real departure, I work on seeing the world through the eyes of a four year old.

INCOSE ONLINE

Getting a New look at www.incose.org

Randy Case, Comm2 Electronic Media Subcommittee Chair rcase@esv.com.

Our web site will be getting a face lift. We have recently completed a RFP process to upgrade the graphic design and provide webmaster services to our web site.

We spent some time at the Boston Symposium talking to the Technical Board, members, and the Board of Directors. Based on what we heard, we generated a set of requirements for both the graphic design and the webmaster functions that we felt were needed to support the activities of INCOSE.

We then sent out the request to 237 graphics designers and webmasters, and also posted the announcement of the RFP to 5 UseNet news groups.

We received 39 positive responses (and 14 proposals).

Our next step was the evaluation of the proposals. This was done in two phases. First, a member of the subcommittee reviewed a proposal for a go/no-go as to the ability to meet the INCOSE needs (as set forth in the RFP).

The second phase evaluated of the "go" proposals. We did this in two parts: 1) we "scored" the proposals using at least 2 members of the subcommittee, and then 2) we used cost to fine tune the selections.

This narrowed the selection down to the best two or three that we will take to the entire Communications Committee for the final selection (or to the Board of Directors if we feel that we need to).

SE Home page from George Mason University

Dennis Buede, dbuede@gmu.edu

The 1995-1996 Senior Design Class of the Systems Engineering Department of George Mason University has completed a web page, the purpose of which is to communicate to high school students what systems engineering is. The seniors wrote a proposal to the faculty to initiate the project, developed requirements and performed a functional analysis, wrote and debugged the HTML code, and developed a test plan that included faculty, freshmen and CS student testing; the CS students were instructed to find ways to crash the code. In addition, they had to manage themselves (probably the hardest task).

The result of this activity can be seen at:

http://www.site.gmu.edu/-syst/InSERT

The freshmen testers were overwhelmingly complementary. The project was submitted to a university wide competition called the Technology Learning Competition and was awarded first prize. We are going to send information about the web page to all of the high school guidance counselors in Virginia this fall.

Please feel free to provide us with any comments. This next year's Senior Design Class will be tasked with upgrading this "system."

E-Mail Reflector Splits in Two!

Randy Case, rcase@esy.com

Based on direction from the Technical Board and the Board of Directors given at the Symposium in Boston, the INCOSE e-mail reflector has been split into two different lists: a general discussion list and an administrative list. The current list will be discontinued in the near future.

The discussion list is a forum for discussion of questions, issues, lessons learned, best practices, research topics, and sources of additional information on systems engineering.

For INCOSE members to subscribe, send e-mail to:

incose-discuss-request@xor.com

with the following command in the body of your e-mail:

subscribe incose-discuss your-e-mail-address

If, for some reason, you wish to be removed from the discussion list, send e-mail to:

incose-discuss-request@xor.com

with the following command in the body of your e-mail:

unsubscribe incose-discuss your-e-mail-address

To post a message, send e-mail to:

incose-discuss@xor.com

The discussion list is not moderated, and anyone can post to it. There are currently 279 INCOSE members (and affiliates) on the list.

The administrative list is devoted to the announcements of INCOSE and systems engineering related meetings, workshops, publications, and for communication of INCOSE business to the membership. It is a moderated list.

To subscribe, send e-mail to:

incose-admin-request@xor.com

with the following command in the body of your

e-mail:

subscribe incose-admin your-e-mail _address

If, for some reason, you wish to be removed from the list, send e-mail to:

incose-admin-request@xor.com

with the following command in the body of your e-mail:

unsubscribe incose-admin your_ e-mail-address

To post a message, send e-mail to:

incose-admin@xor.com

There are currently 291 INCOSE members (and affiliates) on the administrative list.

Symposium Abstracts on the Web

Bill Schoening (wschoening@mdc.com)

Abstracts for papers published in the Proceedings for INCOSE symposiums since 1991 are now available on the INCOSE home page at

http: // www.incose.org

under "INCOSE Web Site Library Index" at the bottom of the page. As an alternative, go directly to

http:/ www.incose.org/lib/index.html

You can download abstracts either as a single file for all years or as one file per year. Once downloaded, the abstracts can be read using standard word processing applications. Each abstract includes the title, author, year of publication, and the abstract itself. Thanks go to Lew Lee for getting the 1996 abstracts assembled and loaded.

The Information **ByWay**

Jack Fisher, seajnf@aol.com

I find myself buying more books than ever before. I feel a compulsion to keep up with the literature in systems engineering, software engineering, quality, risk management and general engineering as well as studies related to the design, development and operation of many types of systems. I am many books behind in my reading. Nevertheless, I still haunt the local bookstores and delight in reading book reviews and bibliographies looking for that one gem that is missing from my book shelves. Once I discover the existence of a book, the game becomes where to find it. Here are some of the locations where I have been buying books recently: Bookstores. I buy many books from large bookstores such as Borders and Barnes and Noble. Most cities in the USA will have one or both of these stores. Both are excellent, carry many technical and business titles, and will handle special orders by mail.

Computer Literacy Bookshops. Computer Literacy has a huge selection of computer/software, other technical books as well as many business titles. Stores are located in Silicon Valley (San Jose, Sunnyvale and Cupertino) and Tysons Corner, VA. Orders can be placed at (408) 435-0744.

Amazon.com Books. Amazon, an inter-net-age bookstore located in Seattle, WA, advertises itself as the "Earth's Biggest Bookstore" and well it might be. It claims to carry over a million titles. After you access the Web Page at http://www.amazon.com, you can browse through different indices, read reviews of various books written by customers, fill your shopping basket with books and pay for them either directly or use your phone to give Amazon your credit card number. A real experience!

US Government *Printing Office (USGPO).* This is the source that non-government personnel can use to obtain DSMC Publications such as the System Engineering Management Guide (which is being revised and should be available before the end of the year). DSMC has a number of other excellent publications, all of which are available from the USGPO if they are in print. NASA Special Publications are also available from the USGPO. There are USGPO bookstores in 22 cities around the U. S., two stores in Washington, D. C., and a retail sales outlet in Laurel, MD that can be reached at (301) 953-7974. With the USGPO you have to know what you are looking for as they have a huge variety of publications available.

National Technical Information Service (NTIS). NTIS is a Federal Agency within the Department of Commerce. It adds publications at a rate of 70,000 per year from such diverse sources as NASA, and the Departments of Defense, Energy, Commerce, and Transportation. It is a good source for information on CALS, and IS0 9000 implementation and can provide DoD documents such as Directive 5000.1 and Instruction 5000.2. It publishes an annual catalog of products and services. Orders can be placed at (703) 487-4650.

National Academy Press (NAP). NAP was created by the National Academy of Sciences to publish the reports issued by the Academy and by the National Academy of Engineering, the Institute of Medicine, and the National Research Council, all operating under the charter granted by Congress. It publishes technical reports and books on a variety of topics. Orders can be placed at (800) 624-6242.

DoD Single Stock Point (DoDSSP). This is the source for DoD Standards and Specifications and is located in Philadelphia. Up to 5 copies of any of these can be obtained at no change. It has a computerized ordering system called TeleSpecs, which can be reached at (215) 697-1187 through 1198. To use this system you must have a customer number which can be obtained through the Special Assistance Desk at (215) 697-2667/2179.

Global *Engineering Documents.* Global is a source for just about any kind of engineering standard, specification or handbook that you can imagine. It carries DoD, Electronic Industries Association, Telecommunication Industries Association Standards as well as many others. Global is not inexpensive, but it carries just about everything. Global Professional Publications, a division of Global Engineering, publishes technical books, with many titles in Computer and Software Engineering. Orders can be placed at (800) 854-7179.

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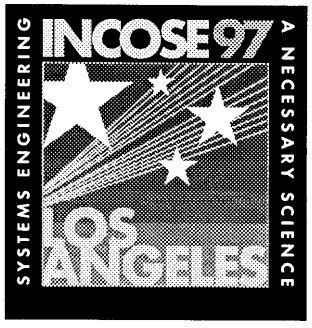
Smithsonian Institution Press (SIP). SIP is a division of the Smithsonian Institution and publishes in numerous fields, including air and space, anthropology, fine arts, natural history, and American studies. Its catalog contains a number of interesting titles in air and space, famous aircraft, military history, and the history of aviation. Orders can be placed at (800) 782-4612.



Call For Papers

"Systems Engineering: A Necessary Science"

The International Council on Systems Engineering

August 3-7, 1997

Systems engineering must be practiced more as a science if we are to be able to successfully architect, engineer and produce complex systems. The INCOSE 1997 Symposium will explore solutions to the challenges facing systems engineers today and in the future. Papers are being solicited that address the symposium theme, "Systems Engineering: A Necessary Science." The terms "necessary" and "science" should be understood in the broadest sense. "Necessary" is meant to emphasize the benefits of systems engineering. "Science" is meant to imply a discipline that includes the technical and management aspects of systems engineering.

Papers are being solicited in 3 categories-Research, Develop ment and Application-for the 6 tracks listed below. Papers in the Research category should address basic research efforts centered on providing strong and uniform theoretical foundations for system engineering. Papers in the Development category should address efforts to put theory into practice. Papers in the Application category should address efforts associated with taking an existing development and putting it to some practical or specific use.

Systems ***Engineering Applications***
- Systems engineering within and across application domains.

Measurement
- Methods to measure systems engineering, including best examples of those measurements

Systems Engineering Processes and ***Methods***
- Engineering management methods that apply to the definition, development, and support of systems

Education and Training
- Systems engineer development

Systems Engineering ***Management***
- Engineering management methods that apply to the definition, development, and support of systems

Modeling and Tools
- Use of commercial off-the-shelf tools and methods to advance the state of the practice of systems engineering

Authors: Final, camera ready papers will be required for 1997. Complete paper format and submission requirements are described in a Paper Requirements and Guidelines Packet that each author must obtain. This packet may be obtained by contacting the technical or administrative contacts listed below or by accessing the 1997 INCOSE Symposium Web site:

URL=http://www.trw.com/incose/

Important Dates:

Camera Ready Paper Submission: ***January 7, 1997***
Acceptance Notification: ***March 7, 7997***

NO FAXED OR E-MAIL PAPERS ***WILL BE ACCEPTED.***

Papers that are received after the deadline or do not meet the formal and submission requirements contained in the Paper Requirements and Guidelines Packet will not be reviewed. Accepted papers will be published in the 1997 INCOSE Symposium proceedings and presented at the symposium.

Students: A limited number of student grants to help with travel expenses and registration fees may be available to qualifying students whose papers have been accepted. Information about and applications for the student grant program may be obtained by contacting the contacts listed below or by accessing the INCOSE Web site described above.

Technical Questions:

Lisa Hritz
Hughes Space and Communications
EO/EO1/D110
PO Box 902
El Segundo, CA 902454709
Tel: 3 1 O-416-5 153
Fax: 310-416-5188
E-mail: Lhritz@ccgate.hac.com

Send Papers to:
Ellen E. Barker
Engineering Professional Programs
University of Washington
3201 Fremont Avenue North
Seattle, WA 98 103-8866
Tel: 206-543-5539
Fax: 206-543-2352
E-mail: uw-epp@engr.washington.edu

***Hosted* by** the Los Angeles Chapter

Information ByWay (continued)

American Institute of Aeronautics and Astronautics (AIAA). The AIAA publishes and makes available a number of textbooks, other technical books, reports and a few standards. It publishes an annual catalog, and orders can be placed at (800) 682-AIAA.

American Society for Quality Control (ASQC) Quality Press. The ASQC administers the Malcolm Baldrige Quality Award for the National Institute of Standards and Technology and the is the U. S. publisher of the IS0 9000 Quality Standards. They also publish and sell books under the Quality Press imprint. It prints a catalog several times a year with many titles including total quality management, reliability, quality, statistical process control, and inspection. Books may be ordered at (800) 248-1946.

Quality Resources. Another publisher with many quality titles is Quality Resources. It publishes a number of books on Baldrige Award strategy and IS0 9000 quality requirements. Orders may be placed at (800) 247-8519.

Krieger Publishing Company. Krieger, located in Melbourne, FL, specializes in out-of-print technical books although they are now soliciting original manuscripts. The catalog lists many books in all fields of engineering. The Krieger direct order line is (407) 727-7270.

RAND. RAND, located in Santa Monica, CA is a nonprofit institution devoted to the research and analysis of public policy issues. Project Air Force within RAND is a federally funded research and development center (FFRDC) devoted to the analysis of operations, technology and resource management for the U. S. Air Force. RAND also operates the Arroyo Center, an FFRDC, for the U. S. Army. Many research publications are available directly from RAND. It publishes bibliographies covering such subject areas as logistics, space technology and planning, R& D, systems acquisition, and systems analysis: methods, technique and theory. A Web Page, located at http:/ /www.rand.org/, provides a listing of available documents. Orders can be placed by phone at (310) 451-7002 or by e-mail at order@rand.org.

Publishers. I also order books directly from publishers when they are not available from bookstores. Phone numbers of publishers I have ordered from recently include the following:

Cambridge University Press (800) 872-7423
Cornell University Press (607) 277-2211
Dorset House (800) 342-6657
Harper Collins (800) 331-3761
Harvard Business School (800) 545-7685
Irwin (800) 634-3966
Microcosm (310) 539-9444
Penn State Press (800) 326-9180
Prentice Hall (800) 947-7700
Wiley/Interscience (800) 879-4539

Columnists

Does INCOSE Build On Its Own Knowledge?

Sarah A. Sheard, sheard@aol.com

Is it hard to justify to your management your expenses in attending INCOSE symposia? Are the papers in each symposium advancements in the state of the art? Are you satisfied with INCOSE's ability to earn respect in the professional world?

If INCOSE is going to convince the world that there is a discipline of systems engineering, and that INCOSE is the repository of knowledge about it, then INCOSE members must read INCOSE work and build on it. From the graphs shown here, does it appear we are doing so?

Notes about Figures and Table

In Figure 1, the bars show the number of papers in Volume 1 of the Proceedings for each year, the number that cited any references, and the number that included references to INCOSE work. References to the same authors' own works are not considered to be INCOSE citations, since the objective of the study was to determine if authors are building upon the body of INCOSE knowledge.

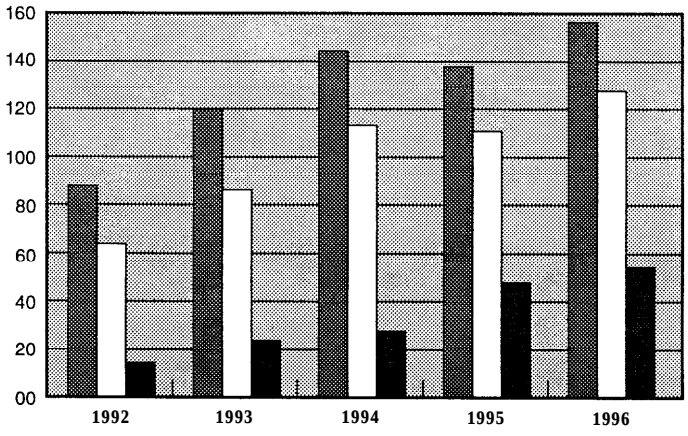


Figure 1 References in Proceedings

In Figure 2, the first bar for each year shows the average number of references in the papers that had any references. The second bar for each year shows the average number of references to INCOSE work.

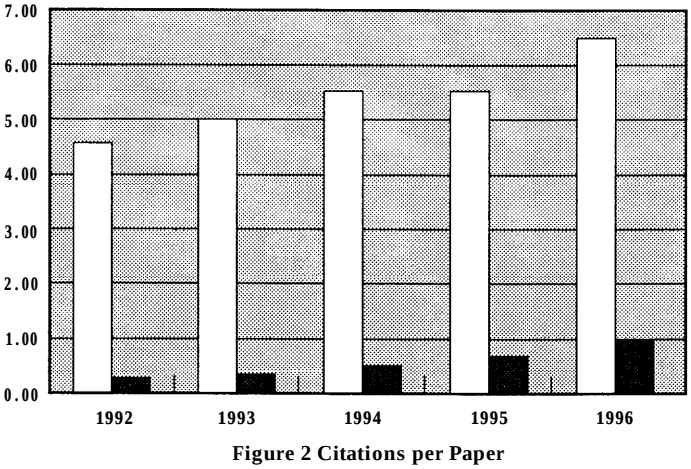


Figure 2 Citations per Paper

The summary data used to create these graphs are shown in Table 1.

	Number of Papers	Papers with References	Papers with INCOSE Reference	Percent Papers with INCOSE	Percent INCOSE Citations		Citations per Paper	INCOSE Citations per Paper
1992	87	63	14	22%	6%	1992	4.48	0.28
1993	121	86	23	27%	7%	1993	4.99	0.37
1994	147	115	28	24%	9%	1994	5.50	0.50
1995	139	112	48	43%	13%	1995	5.49	0.74
1996	158	129	46	36%	16%	1996	6.57	1.02

Table 1 Data on References Summary

What is considered INCOSE work?

References cited in the 1991 Proceedings are not analyzed here, since in 1991 there was no previous INCOSE (NCOSE = INCOSE) work to cite. However, since then the amount of systems engineering information has grown considerably. Each year, Proceedings volumes provide over 1000 pages of information; the inaugural issue of Systems Engineering (the Journal of INCOSE) was published in 1994, and INCOSE is increasingly releasing working group products such the Systems Engineering Capability Assessment Model and the Systems Engineering Metrics Handbook. All of these are considered INCOSE references, as are communications noted to be part of INCOSE meetings.

Books such as Blanchard and Fabrycky, Rechtin, Friedman, Grady, or Lacy's on systems engineering, even though they were frequently cited and were written by INCOSE members, are not considered INCOSE references.

Facts

- **The** fraction of papers which cite references is increasing, from 72 percent in 1992 to 82 percent in 1996.
- Of the papers which had at least one reference, 22 percent of the 1992 papers cited any INCOSE work. This number is increasing overall, to about 40 percent in 1995-1996.
- The number of references is increasing, from an average of 4.5 per paper in 1992 to 6.6 in 1996.
- Citations of INCOSE work, as a fraction of total number of citations, increased from 6 percent in 1992 to **16** percent in 1996. The average number of citations of INCOSE work per paper is also increasing but still small, increasing from 1 INCOSE citation per 3.6 papers in 1992, to 1 per paper in 1996.

Opinions

Too many papers cite no references at all. Some of these are strictly opinion papers, and others are case studies, but the authors have made no attempt to place their work in the context of the INCOSE body of knowledge.

Too few INCOSE authors cite other INCOSE work, suggesting they didn't read the previous work, or else did not care to discuss the connection of their work to previous work.

However, the wealth of non-INCOSE references suggests that INCOSE is at least not stagnating, as members are reading work in many other fields and bringing the information into the field of systems engineering.

Recommendations

I recommend all potential authors of 1997 papers read INCOSE proceedings papers and the INCOSE Journal (of which the second issue, a joint issue with the IEEE, should be coming out soon). Let's learn from each other, and build on INCOSE work.

If you are working on Risk Management, for example, look for Risk and Management in the 1996 Proceedings Keyword Index, and search for Risk Management on the CD-ROMs. Download each year's abstracts from our Web site and search for your topic with Word, Adobe, or another tool. Check our Web site for a relevant Working Group, and contact them. When you find something useful, incorporate it into your paper, and cite the source in your references section.

The 1997 Graphs

Previously there have been complaints that INCOSE is not scholarly enough, that writing papers and attending the conferences is something of a boondoggle. Related complaints have been that papers at each symposium reinvent previous work and previous conclusions. Reading previous work will allow us to learn lessons the easy way; we can then start from a new platform in our own work. If INCOSE can report that 1997 papers cited an average of 3 to 5 other INCOSE works, this will signify both that we are more scholarly in our paper writing and also that we are solidifying as an organization, building a profession with a knowledge base of its own.

Explaining Systems Engineering

Bill Schoening,wschoeningQmdc.com

I seem to have a difficulty concisely describing what a Systems Engineer is and does. I can get by with "Systems Engineers are concerned with who uses a product and how they use it" for those without much engineering background. Unfortunately, I tend to stumble around those with strong, broadly based engineering backgrounds. Most in the latter group do some systems engineering on the job (just as they do math without calling themselves mathematicians). They have difficulty understanding why systems engineers want to claim some parts of their job.

Sarah Sheard's paper in the 1996 Proceedings, "Twelve Systems Engineering Roles," has proven to be a successful way out of the dilemma. I use it to explain not only what systems engineers do, but how most engineers do some systems engineering regularly. Almost all engineers can identify with one of the roles Sheard has described, and they can do so without feeling that they are being redefined as systems engineers against their will. So after a short discussion about systems engineering (and before the audience tunes me out), I break off the discussion with a promise to send Sheard's paper.

Many call to learn more, or bring it up in a later conversation. There appear to be several reasons for the success of this approach. People like to identify with good ideas provided they are not made to feel like outsiders. They are more comfortable when they can digest the information at their own pace from a paper that is readable and has good examples. Also, the paper is written by a third party.

If you would like to use "Twelve Systems Engineering Roles" to help you explain systems engineering, it is available on page 481 of the 1996 Proceedings. (On the CD-ROM, some paragraphs on the next to last page are out of order; the paper copy is your best source.) The paper is also available from ftp.software.org, ncose folder, rpapr.doc (in Netscape just type ftp://ftp.software.org/ncose/rpapr.doc where you normally type in a web address.). After down loading and saving the paper, use a word processor to read it. (The paper was originally written in Word 6.0.)

REFLECTION ON THE ORIGINS OF THE COUNCIL

Jerry Lake, lakejg@smisyseng.com

In August of 1990, a small but dynamic group of pioneers met at the Battelle Conference Center in Seattle to discuss how better system engineers could be developed and the practice of systems engineering improved. The purpose of this article is to review the background and results of the founding meeting of the Council and to provide a trace of selected pioneers' accomplishments. The background and results come from published meeting minutes and my notes. The accomplishments of pioneers come from my recollection as an active member of the Council for the past six years.

BACKGROUND

The August 1990 founding meeting was actually not the first. In 1989 Jeff Grady and Brian Mar brought a smaller group of industry and academic folks together in LaJolla to explore how better system engineers could be developed. The issue then was the split personality of systems engineering with respect to organization versus process. Brian Mar was tasked with putting together a follow-on meeting in 1990.

The organizing committee for the 1990 meeting included: Gerald Chasko (DSMC-West), Jeff Grady (General Dynamics), W.E. Forbes (McDonnell Douglas), Brian Mar (U of Washington), Barney Morais (Synergistic Applications), R.E. Sorensen (Unisys), and Carl Spiegelberg (Boeing). The invited attendees who participated included: Henry Alberts (DSMC), Jim Brill (Hughes), Charles Brown (USAF), Curt Brudos (Martin Marietta), Harry Carlson (Lockheed), David Clemons (General Dynamics), Jim Cloud (Motorola), Jack Fisher (Hughes), Erick Flocken (LTV Aerospace), George Friedman (Northrop), Bob Gaylord (Aerospace), Don Gustafson (Texas Tech), John C. Howe (TRW), S. Krishnamurthy (Bechtel National), Jerry Kronk (Boeing), Jim Lacy (Texas Instruments), Jerry Lake (DSMC), Ken LaSala (HQ AFSC), Ken Ptack (PRC), Larry Pohlmann (Boeing), Robert Roe (Boeing), Richard Schmidt (IIT Research), Kenneth Sivier (U of Illinois), M. Swiontek (ESL), E.C. Taylor (TRW), Ernie Unwin (San Jose State), and Wayne Wymore (SA&DS).

The attendees were definitely not of one mind with respect to defining systems engineering. The price of admission was a definition. Brian Mar grouped the definitions into four domains. Figure 1 provides a four square model of these domains.

Those in the first domain (Technical System and Process) focus their definition on a Systems Engineering Process. This database driven process is used to generate specifications from requirements. In this domain the system engineer is an individual who is knowledgeable in all technological aspects of the product and can architect that product using the systems engineering process. In theory, this technical process is the key to the other three domains. There was a consensus that there was a lack of knowledge of the systems engineering process by graduates of engineering schools.

	Technical System	Program Management
Process	Systems Engineering Process	Total Program
Architecture	Buy, Make, Grow Wise People	Holistic Development

Figure 1 - Systems Engineering Definition Domains

Those in the second domain (Program Management and Process) consider systems engineering as encompassing the total program. In this case the system engineer must not only have the knowledge identified in the first domain, but must also be able to apply the systems engineering process to the entire management of the development and operation of the product system.

The third domain (Technical System and Architecture) considers the main task as one of making, growing, and/or buying wise people to accomplish the job. These people do not necessarily need to know systems engineering. The person needed is an architect who may be looked upon as the person with the big picture (who knows it all).

Those in the fourth domain (Program Management and Architecture) consider the whole development effort from a management perspective. Those in this camp felt that product systems have become so complex that a single individual cannot have adequate knowledge of the product system nor the product development and operations process. They believe a team approach is required to apply the systems engineering process. Individuals that meet the first two definitions will be needed, and all team members may also need to understand the systems engineering process.

When the attendees, based on these four domains, were formed into subgroups to develop an action plan that would enhance the practice of systems engineering and the development of system engineers, there were no volunteers for domain three.

RESULTS

The findings and recommendations of the three subgroups were surprisingly similar, given the large differences in their initial perception of systems engineering. The attendees unanimously voted to create a National Council on Systems Engineering (now known as the International Council on Systems Engineering—1995 Council action) with attendees as the charter members. The attendees elected as co-chairpersons for the council: Harry Carlson (Industry), Jerry Lake (Government), and Brian Mar (academia). A subcommittee drafted a charter for the new Council. John Howe chaired the committee consisting of Charles Brown, Harry Carlson, Jerry Lake, Carl Spiegelberg, and Wayne Wymore. The following charter was adopted by the attendees:

1. To foster the definition, understanding, and practice of world class systems engineering in industry, academia, and government.
2. To provide a focal point for dissemination of systems engineering knowledge.
3. To promote collaboration in systems engineering education and research.
4. To assure the existence of professional standards for integrity in practice of systems engineering.

In addition, the attendees acting as a committee of the whole defined tasks and chairpersons to accomplish the following:

1. Develop a definition of the systems engineering process that will be accepted by industry, government and academia.
2. Develop a strategy, resources, and an action plan to document case studies of systems engineering effectiveness in major system developments.
3. Document the current university activities to develop system engineers, and to conduct systems engineering research.
4. Enhance systems engineering education and research in the universities.
5. Inventory industrial systems engineering training efforts and transfer these teaching materials and courses to the universities.
6. Develop collaborative efforts for industrial training of system engineering that can be transferred to the universities.
7. Enhance the interface between DSMC and Council member organizations.
8. Establish a process to certify the maturity of systems engineering practice of any organization.

Most of these tasks still need to be accomplished. Some already have been well done with enthusiasm.

TRACKING THE PIONEERS

From an enthusiastic beginning the achievements of the pioneers who attended this founding meeting have been notable. It is interesting to note the long term contribution to the Council that the founders have made. These contributions are laudable and deserve recognition. With the risk of leaving some very important contributions out, I provide the following. My apologies to those overlooked or achievements incorrectly stated. I have tried to show approximately when pioneers became non-active in Council work/membership. The loss of any member, especially a pioneer, is always of concern and their contributions sorely missed.

Members should take time to show their appreciation to those below who have gone the extra mile to establish and nurture the Council.

Jim Brill–Chair first Membership Committee, Gained Hughes as Corporate Sponsor, First Director-at-Large, Fourth President, Current Past President

Curt Brudos–Chair Communications Committee

Harry Carlson-Served as Co-Chair (Industry), Elected first Past President, resigned 1992

Jim Cloud-Co-Chair first Communications Committee, Elected to first Council Board, Current Member Corporate Advisory Board (Motorola)

David Clemons-Elected to first Council Board

Jack Fisher-Co-Chair first Systems Engineering Development Committee

George Friedman-Chair first Budget Committee, Co-Chair first Nominations/Elections Committee (West), Gained Northrop as first Corporate Sponsor, Hosted Annual Business Meeting at Northrop, Third President

Bob Gaylord-Hosted first Council Business meeting at Aerospace (1991), no longer active after 1991

Jeff Grady-Elected first Council Secretary, editor of the first Council Journal

John C. Howe-Co-Chair first NCOSE Development Committee, Red Sweater associated with Founders Award based on his wearing of a red sweater at all early meetings of the Council (see the Historical Note on page 36), no longer active after 1991

Jerry Kronk-Co-Chair of first Ways and Means Committee, no longer active after 1992

Jim Lacy-Co-Chair of first Systems Engineering Development Committee, Co-Chair first Nominations/Elections Committee (Mid West), Elected to first Council Board, Elected/resigned Council Treasurer

Jerry Lake-Served as Co-Chair of Council (Government), Elected first President, Appointed Director-at-Large, Elected/current Director-at-Large, Current Member Technical Board, Second recipient of Founders Award (1996)

Brian Mar-Served as Co-Chair of Council (Academia), Elected first President Elect, Second President
Barney Morais-Co-Chair first Communications Committee, Elected first Council Treasurer, Served as first Executive Director
Ken Ptack-Co-Chair first Nominations/Election Committee (East), Gained PRC as Corporate Sponsor, Corporate Advisory Board Member (PRC), Current Chair Corporate Adv. Board, Current Member Council Board
Larry Pohlmann-Chair first SE Practices Committee, Chair first Technical Board, Elected Council Board, President Washington Metropolitan Chapter, Member Technical Board
Richard Schmidt-Current Member Corporate Advisory Board (Ascent Logic)
Kenneth Sivier-Co-Chair Development Committee, Elected/resigned Council Board
Carl Spiegelberg-Co-Chair first NCOSE Development Committee, First recipient of the Founders Award (1991), no longer active after 1991 retirement from Boeing
E.C. Taylor-Co-Chair first Ways and Means Committee, Hosted Annual Business Meeting (TRW), no longer active after 1992
Ernie Unwin-Co-Chair Systems Engineering Development Committee (Academia)
Wayne Wymore-Elected first Council Board, Current Member Council Board

SUMMARY
We have come a long way in six short and exciting years. The statistics are impressive. The foundation laid by the pioneers who participated in the August 1990 meeting has been added to by many energetic younger members since then. These too deserve your special recognition.

Yet, there is much more to do and more achievements and achievers before us. The future and hope of INCOSE is not in the founders, but in today's members.

INCOSE HISTORICAL NOTE

Larry Pohlman, pohlmann@boeing.com

Why is a red sweater a part of the INCOSE Founders Award?

The founding meeting of INCOSE (then it was called NCOSE) occurred in July of 1990, at Battelle Northwest in Seattle. A team of two people, Mr. John Howe of TRW and Mr. Carl Spiegelberg of Boeings co-authored our charter statement at that meeting. During both days of the meeting, John wore a bright red sweater-bright enough to be noticed and commented on by several of the 34 attendees at this founding meeting. When the first Founders Award was made to Carl Spiegelberg in 1992, it was decided to include a red sweater as part of the award. Again the brightly colored sweater drew comments. Our leadership at the time, which included Dr. Jerry Lake, decided that the red sweater tradition should be continued. So, this summer as a Founders Award was presented to Dr. Lake, he also received a red sweater. We hope that Jerry, and all future Founders Award recipients, will enjoy their red sweaters!

The Business Case Context in Symposium Presentations

Bill Schoening, wschoening@mdc.com

In his presentation at the Boston Symposium, Jim Murphy startled me when he said that the requirements for the next upgrade to his nuclear waste facility would not be known until the users had a chance to use it as currently constructed. My first reaction was, "How could they possibly design for a future that was that vague?"

After a few questions, I realized that Murphy and his colleagues did indeed have to accommodate future upgrades without any real idea about what those upgrades might be. This is hardly what happens when designing commercial aircraft or TV sets.

Having had my frame of reference suddenly revised, I realized the importance of the problem context. Murphy's explicit description of context was essential to my understanding the presentation. This context is just one example of the "business cases" that Beth Clark and her Business Applications Domain working group are trying to articulate. The specifics of processes and metrics that apply for one business case may not apply for a different business case.

In the presentations that I attended over the next several days, presenters often launched into the details without first describing the business case. I was acutely aware of how my assumptions about context had earlier led me astray. When the context was explained, usually in response to questions at the end of the presentation, a presentation would take on a sharper and sometimes different focus.

My personal request to those planning papers for future symposiums is that you include more about the business case early in your presentation. Is your application primarily for concept exploration or for final development? Are you constrained by the kind of evolutionary development that Jim Murphy faced? A one-time, hard-to-update Hubble telescope program does not have the same business case as cars produced in quantities of hundreds thousands per year or telephone systems with millions of users. Tell your audience about the specialized business case features behind the examples you are citing. I know I will better understand and appreciate your presentation.

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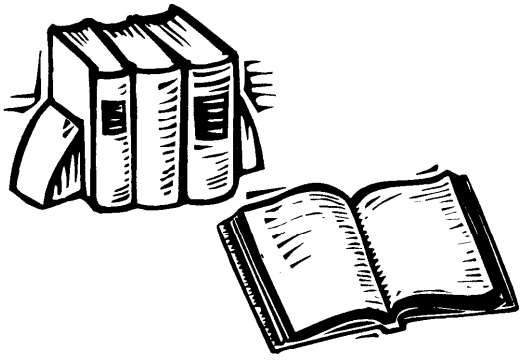
BOOK REVIEWS



Covey's Seven Habits and the Systems Approach: A Comparative Analysis, By Yacov Y. Haimes of the University of Virginia and Calvin Schneiter of Signet Bank. IEEE Transactions on Systems, Man, and Cybernetics, July 1996,

Reviewed by Beth Clark, Communications Committee, eaclark@uswest.com

In the paper "Covey's Seven Habits and the Systems Approach: A Comparative Analysis," the authors argue that the best selling book by Stephen Covey, *The Seven Habits of Highly Effective People* and the systems approach share common principles and philosophy. Each of the seven habits itemized in Covey's book (Be proactive; Begin with the end in mind; Put first things first; Think win / win; Seek first to understand, then to be understood; Synergize; and Sharpen the saw(is related to some principles and / or steps upon which the systems approach is based. The authors' side-by-side comparison shows how the elements correspond and complement each other. Both philosophies stress problem definition, early determination of the desired outcome, and an organized effort to determine a solution. They also promote similar overriding principles to better enable the problem-solving process. Haimes and Schneiter assert that comparing Covey's philosophy to the philosophy of the systems approach may help improve the public's understanding of systems engineering.

Complexity: life at the Edge of Chaos

By Roger Lewin, Macmillan Publishing Co., New York, 1992. ISBN O-02-014795-3, $10.00 (paperback).

Reviewed by Sarah A. Sheard, sheard@software.org

> *I had the sense of complexity as a mirage. I was certain of its existence, until I tried to reach out for it, tried to anchor it in reality.* -R. Lewin

What do the following things have in common: Southwest Indian archeology, neural networks, Gaia, dynamic attractors, the developmental life of algae, and punctuated equilibrium?

Noted biologist and science communicator Roger Lewin weaves these concepts together in a general scientist's dream narrative describing the science of complexity. A discovery textbook in the vein of James Gleick's Chaos, Complexity follows Lewin from Arizona to England, Costa Rica, and the Great Smoky Mountains. Lewin travels to interview noted scientists in fields I never knew existed, such as theoretical ecology and neurophilosophy, as well as in physics, geology, artificial life, mathematics and anthropology.

I was interested in complexity theory because recent INCOSE discussions have suggested that there is no discipline of systems engineering, and perhaps we should be doing complexity engineering instead. The quotation at the beginning of this article certainly can be applied to systems engineering. After reading *Complexity: Life at the Edge of Chaos,* I can make two definite statements:

1. The science of complexity is too new to be spawning substantial engineering applications.
2. The science of complexity has absolutely nothing to do with the work of 95 percent of INCOSE members.

Complexity is a fascinating subject, interesting to generalists, and potentially useful as a growth path for INCOSE. Furthermore, Lewin clarifies a concept Lester Thurow discussed at the 1996 symposium, punctuated equilibrium. Finally, Lewin's writing pulses with the excitement of the scientific method.

Lewin, himself a noted scientist, chronicles his understanding of this new science. He interviews Chris Langton, a member of the Santa Fe Institute, which was established in 1984 to study complexity. Langton explains that complexity lies between randomness and order. "Did you know that cell membranes are barely poised between a solid and liquid state? Twitch it ever so slightly, change the cholesterol [or] fatty acid composition just a bit, . . . and you can produce big changes, biologically useful changes."

Living on the edge of chaos, between unchanging order and randomness, allows life to survive unprecedented environmental changes faster than standard evolutionary theory would allow. Darwin considered evolution to be gradual honing of species based on survival of the fittest. His theory has constantly been

challenged, however, by those pointing to times of seemingly rapid changes, where there are missing links in the fossil record. New evolutionary theory believes that much of the generation of new species occurs rapidly, at specific crisis points, called punctuations, in the overall equilibrium. At major crisis points, which have occurred every 26 million years or so, extinction events have occurred which wiped out up to 96 percent of all species in the world. ("As one statistical wag put it, 'To a first approximation, all species are extinct."') After mass extinction, biological niches open up, and otherwise unprecedented biological creativity and complexities arise. Gradual survival of the fittest merely tweaks the forms that arise during these punctuations.

I was glad to have read Gleick's book on chaos previously, since Lewin seems to assume the reader understands chaos theory. The reader needs to know that in linear, Newtonian physics, systems take one state, which can be predicted with certainty from previous states. In chaos (i.e., non-linear) physics, there are instead dynamic attractors to which systems tend: the state of the system usually stays near the attractor but can rapidly and unpredictably venture far away from previous states.

Lewin extends chaos concepts, which Chaos applied to small systems such as a dripping faucet, to much more complex systems such as population biology and morphology, the development of animal structures.

How does a single fertilized egg turn into the 250 or so cell types that constitute mammalian bodies? How do cells differentiate to become brain, liver or bone cells and cell structures? Lewin convincingly demonstrates that principles learned about dynamic attractors in neural network laboratories can be applied to morphology. For example, eyes have evolved as a collapse of randomness into order, because there is a morphogenic attractor for eyes. Similarly, evolution occurs primarily at times of punctuations in the equilibrium, because the randomness unleashed after extinction collapses into order at morphogenic attractors. This happens orders of magnitude more quickly than Darwin's random mutations.

If Thurow is right, then we are now living during a punctuation, and this book is somewhat scary. Massive changes can and do happen. Those interested in what the changes might be would enjoy reading Complexity: Life at the Edge of Chaos.

Engineering the System Solution: A Practical Guide to Developing Systems

By Jack W. Hunger, Prentice-Hall, 1995.

ISBN 0-13-594524-O.

Reviewed by Michael Ali, ali@cat.rpi.edu

Jack Hunger's book is an excellent tutorial on the application of the systems engineering process to the design of complex systems. The system engineering process is broken into seven steps: obtaining the system perspective, analyzing the mission, planning baseline design and program management, developing specifications, performing analysis and iterations, and conducting design reviews. Each of these steps has a dedicated chapter, with supporting examples.

Hunger emphasizes the importance of mission analysis for avoiding mission impossibles — systems that fail at their intended tasks. Unfortunately, the mission analysis step is probably the one most frequently missed by those unfamiliar with the systems engineering process. Interestingly, the latest object-oriented software engineering methodologies advocate use-case scenario formulation, essentially a mission analysis method, as a key step in formulating a coherent software system architecture (see books by Grady Booch and others).

My only (minor) criticism of the book is that it occasionally uses examples of socioeconomic systems to illustrate some of the points. I think that the book loses focus by including such non-technical examples.

I have used the techniques presented by Mr. Hunger on three projects, each involving the design of Graphical User Interface (GUI)-driven real-time control systems with complex mechatronic and man/machine interactions: a high speed goniometer, a robot pipewalker, and a broadcast satellite distribution system. I have found his methods to be useful in every case.

Overall, this book is highly recommended for anyone desiring to apply the systems engineering process to the design of complex systems.

INCOSE FELLOW AWARD

Wolt Fabrycky, fabrycky@vt.edu

The INCOSE Fellow Award recognizes outstanding leaders who have made very significant contributions (at least nationally visible) to the profession and practice of Systems Engineering. It was approved for immediate implementation by the Board of Directors at the 1996 International Symposium in Boston. Nominations are due by December 15, 1996 in accordance with the procedure and criteria set forth below:

Eligibility

Nominees for the Fellow Award must have been INCOSE members for a minimum of three (3) years.

Number of Awards

This award shall be limited to one percent (1%) of the INCOSE membership. Not more than 1/3 of 1% of the current membership may be given this award each year, except that in the initial year awards may be made up to 1/2 of 1% of the membership at the pleasure of the INCOSE Board of Directors.

Award Criteria

Criteria for this award are intended to encompass excellence in fostering the definition and practice of world class Systems Engineering in industry, government, and/or academia. The criteria fall into three categories. Within the first two, the individual must meet a minimum number of specific criteria; the third category is optional. These categories are:

■ Professional Accomplishments (must meet one of two specific criteria):

a. Technical — Has made significant contributions that relate to Systems Engineering philosophy, concepts, application, and/or methodology. Examples are:

- *Development of a Systems Engineering philosophy or paradigm.
- Application of Systems Engineering concepts or methodology in new areas.
- Significant expansion of Systems Engineering methodology or practice in existing areas.

b. Managerial — Has achieved significant and pattern setting stature in a managerial position. This position may be in Systems Engineering or in related functions within the enterprise interacting significantly with Systems Engineering. Examples are:

- Significantly promoted the practice of Systems Engineering on a broad scale within the enterprise.
- Created an atmosphere for professional growth of associates and/or employees.

■ **Systems Engineering Service (must** meet two of three specific criteria):

a. INCOSE Service — Has volunteered significant, extended, and arduous effort on behalf of INCOSE. Examples are:

- Elected offices/chairmanships.
- Task force/committee assignments.
- Editorial/publications/conference service.

b. Interdisciplinary Activity — Has been active in promoting INCOSE with and among other groups that relate to the profession of Systems Engineering.

c. Publication and Promotional Activity — Has published, promoted and disseminated information about Systems Engineering through recognized media. Examples are:

- Books and journals.
- Conferences and meetings.
- Internet and electronic media.
- Radio and television programs.

■ **Humanitarian Service.** Has been active in community or public service utilizing the Systems Engineering approach, not related to normal job responsibilities. (It is not necessary to meet this criteria for the award. Use of this criteria is optional and should only be considered after the individual has met the minimum requirements within the first two categories). Examples are:

- Hospital or school boards.
- Charitable community activity.
- Government or civic service.
- Colleges or universities

Nomination Procedure

Nominations must be submitted along with biographical data and the names of three individuals who have consented to serve as references. Two of these references must be an INCOSE member in good standing and, after the first year, one reference must be an INCOSE Fellow. *A nomination form is on the next page.*

Implementation

An implementation procedure will be established by the Committee on Awards and Recognitions. The INCOSE Board of Directors will act on the recommendations of the Committee at the Winter Workshop. Awards may be announced prior to the Annual International Symposium, with citations and formal introductions to be made at the Symposium.

International Council On Systems Engineering
Fellow Award Nomination Form.. **.Confidential**

The undersigned wish to nominate _____

Biographical data (attach sheets) _____

_____

Mailing address _____

_____

Telephone _____ Fax _____ E-mail _____

Date of birth _____ INCOSE Member for _____ years.

Currently a member of the _____ Chapter.

Nominator's Name _____ **Signature** _____

Mailing address _____

_____

Telephone _____ Fax _____ E-mail _____

INCOSE Member: Yes ☐ No ☐ If yes, Chapter _____

Give the Names, Addresses, Telephone, and Fax numbers of three individuals that have consented to provide professional references for the nominee.

1. _____
Name *Address* *Phone/Fax*

2. _____
Name *Address* *Phone/Fax*

3. _____
Name *Address* *Phone/Fax*

Nominations must be postmarked by December 15 ***and sent to:***

INCOSE c/o Managing Executive • 2033 Sixth Avenue, Suite 804 • Seattle, WA 98121

INTERNATIONAL COUNCIL ON SYSTEMS ENGINEERING
2033 Sixth Avenue, Suite 804 • Seattle, WA 98121 (USA)
Phone: (206) 441-l 164 or (800) 366-l 164
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FOR NEW MEMBERSHIPS

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Month of Joining *	☐ Jun Jul Aug	☐ Sep Oct Nov	☐ Dec Jan Feb	☐ Mar Apr May
Regular Membership	$60	$45	$30	$75
Student Membership **	$10	$10	$5	$10

* Membership year is from June 1 to May 31

** Student members must be enrolled at least 3/4 time in engineering or related fields,

2. Personal Information **Optional — You may attach a business card.**

Name FIRST M.I. LAST Nickname Check one: ☐ Mr. ☐ Ms. ☐ Dr.

Mailing Address — (NOTE: We prefer to mail to your home address.) Check One: ☐ Home ☐ Office

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3. Professional Information

Company Name/Agency/Institution Position/Title

4. INCOSE Local Chapter Affiliation *Please circle one of the chapters listed in the left 3 columns*

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San Diego (San Diego)
San Francisco Bay Area (Silicon Valley)

Colorado
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Texas
North Texas (Dallas/Ft. Worth)
Texas Gulf Coast (Houston)

Washington
Seattle Metro
Tri-Cities (Richland)

Washington, D.C.
Washington Metro Area

Emerging Chapters

There are over 15 emerging chapters in addition to the chartered chapters listed. Please contact the ***INCOSE*** Central Office to learn about a developing chapter in your area.

Australia Affiliate

Systems Engineering Society of Australia

5. Today's Date _____ ☐ Please do not publish my mailing address, email address and phone numbers in the annual Membership Directory

6. Amount Enclosed $_____ (U.S. Dollars Only)

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About INCOSE

INCOSE is a 2500+ member professional organization of systems engineers and others interested in systems engineering. The purpose of INCOSE is to foster the definition, understanding, and practice of World Class Systems Engineering in industry, academia, and government. Members come from the United States and at least ten other countries. Over twenty local chapters across the United States are joined by chapters and emerging chapters in the UK, Europe, and Canada, and an affiliated organization in Australia. The INCOSE board of directors consists of six elected officers (a president, past president, president-elect, and secretary, treasurer, and director-at-large), ten regional directors from the five US regions, one at-large director, and two representatives of the Corporate Advisory Board. Nineteen companies support the organization as Corporate Advisory Board members, sending representatives, an initial donation, and yearly sustaining donations.

If you are interested in INCOSE membership, contact our central office; the address is given below.

INSIGHT information

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Editor: Valerie Gundrum and LeRoy Botten. Contributing editors include Shirley Bishop, Beth Clark, Ann Larmore, James Sanchez, Bill Schoening.

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• General Information about article submission can be obtained by contacting the Chief Editor as follows:
LeRoy Botten
lbotten@csc.com
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Book Reviews

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INCOSE Central Office: General information, address changes, membership, publications.

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Submit your 150-200 word article that includes accomplishments and recent events. Also, include upcoming dates, speakers, topics, place, time, and contact (name, phone, e-mail) for the Calendar *of Events*. Please forward Chapter newsletters so that articles that are of interest to our readers can be included. A name, e-mail address and/or telephone number must be sent with the material. Electronic mail (ASCII/text) is graciously accepted.

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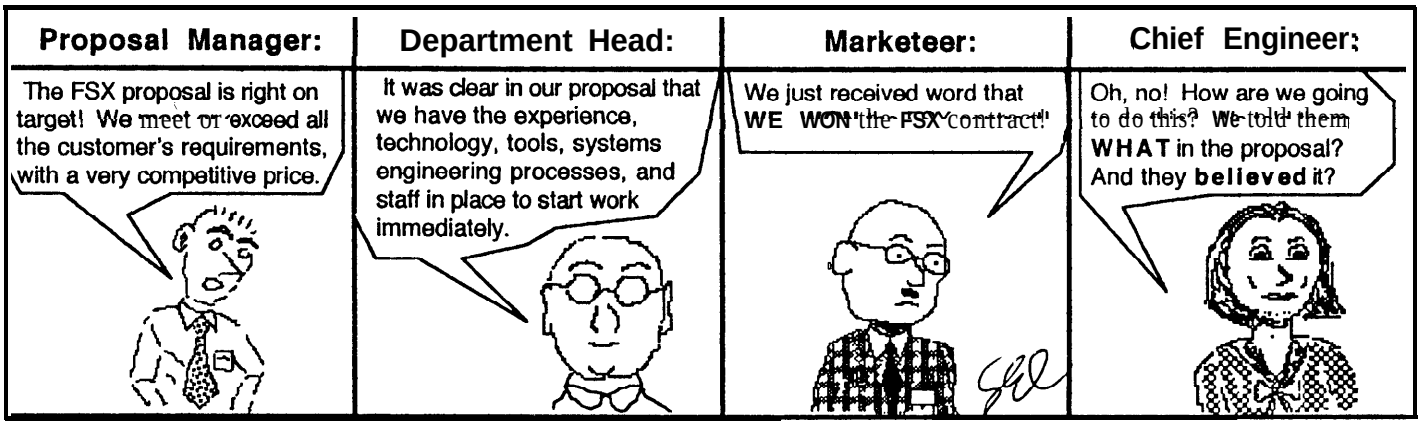

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